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SEPTEMBER 1957

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(1) Farmer, D. A.: M. Clin. North America *38*:1403, 1954. (2) Lichtman, S. S.: Diseases of the Liver, Gallbladder and Bile Ducts, ed. 3, Philadelphia, Lea & Febiger, 1953, vol. 2, pp. 1146, 1150, 1302. (3) Rosser, J. H., and McCall, R. A.: U. S. Armed Forces M. J. *5*:658, 1954. (4) Schwimmer, D.; Boyd, L. J., and Rubin, S. H.: Bull. New York M. Coll. *16*:102, 1953. (5) Best, R. R.; Rasmussen, J. A., and Wilson, C. E.: A.M.A. Arch. Surg. *67*:839, 1953. (6) Pearse, H. E.: Am. J. Surg. *89*:1191, 1955.

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1. Zintel, H. A.: *Surg. Clin. North America,* 36:257, Apr., 1956. 2. Freeman, B. S.; and Young, T. K., Jr.: *Arch. Surg.,* 61:1145, Dec., 1950.

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Erythromycin and Erythromycin-Neomycin for Intestinal Antisepsis 402

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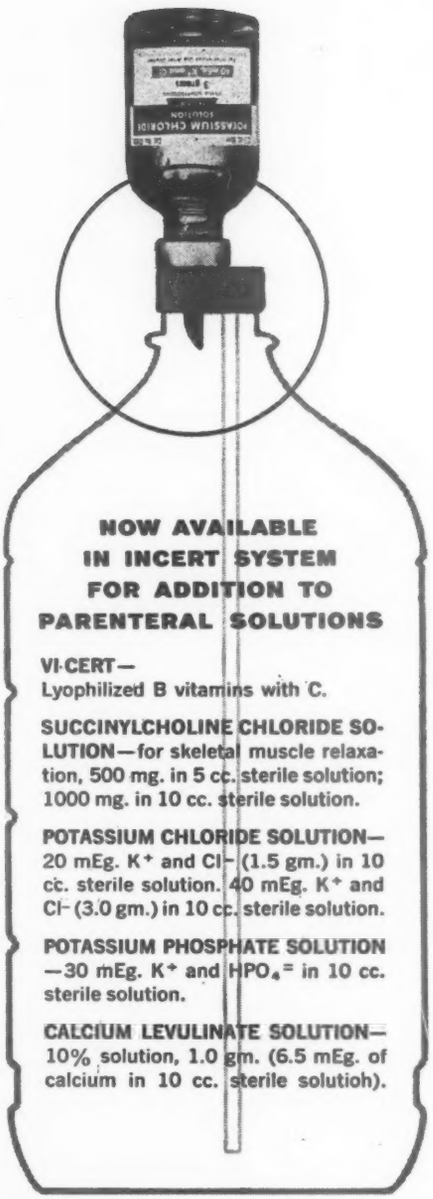

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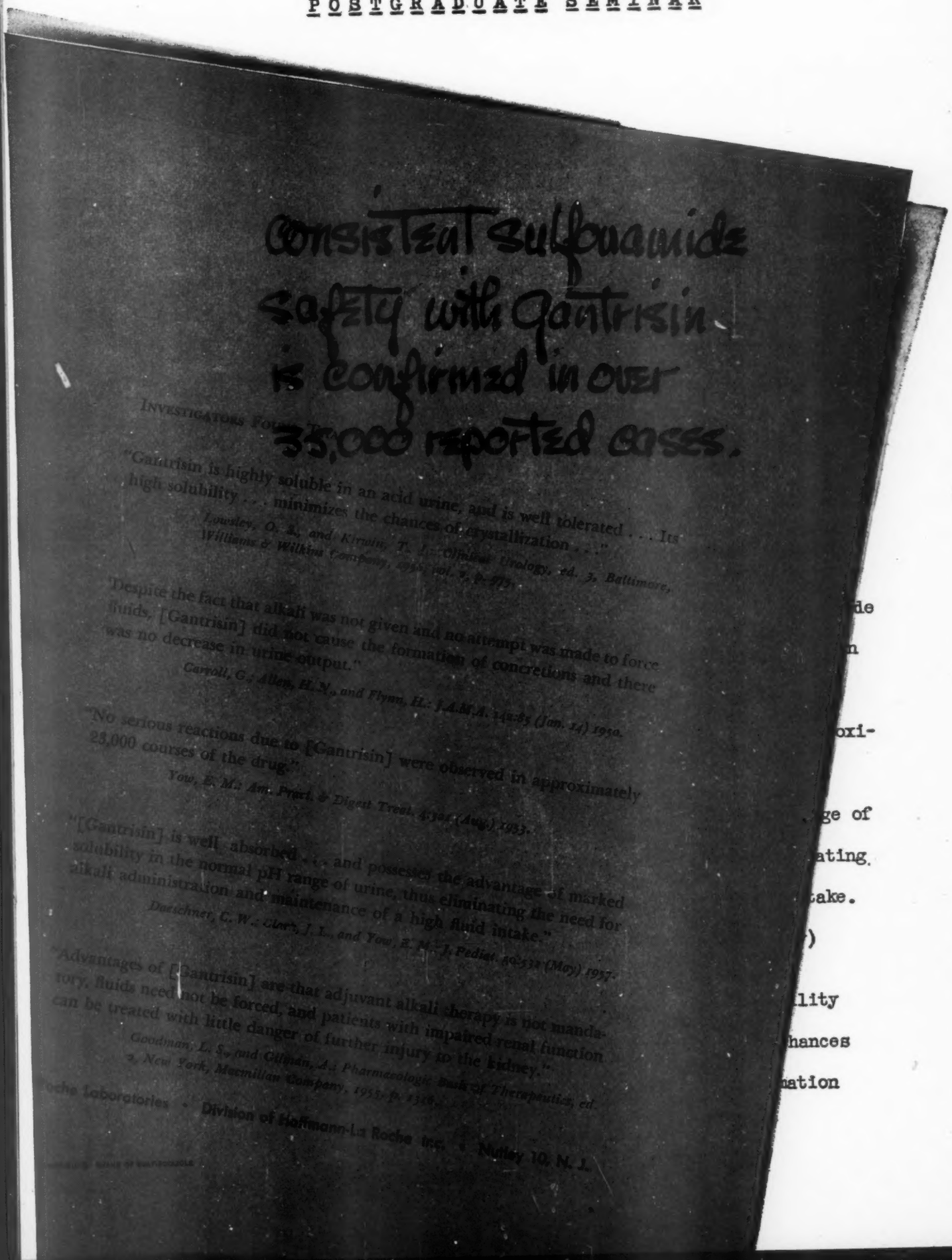
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Carroll, G., Allen, H. N., and Flynn, H.: J.A.M.A. 142:85 (Jan. 14) 1950.

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Yow, E. M.: Am. Pract. & Digest Treat. 4:302 (Aug.) 1953.

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Dorschner, G. W., Clerx, J. L., and Yow, E. M.: J. Pediat. 50:532 (May) 1957.

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Goodman, L. S., and Gilman, A.: Pharmacological Basis of Therapeutics, ed. 2, New York, Macmillan Company, 1955, p. 1318.

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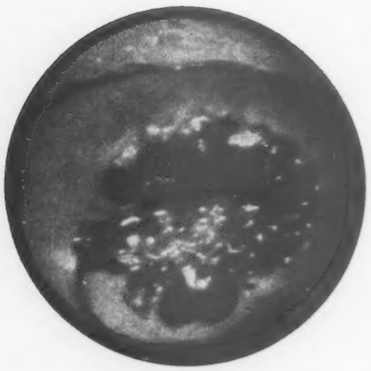

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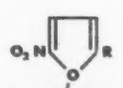

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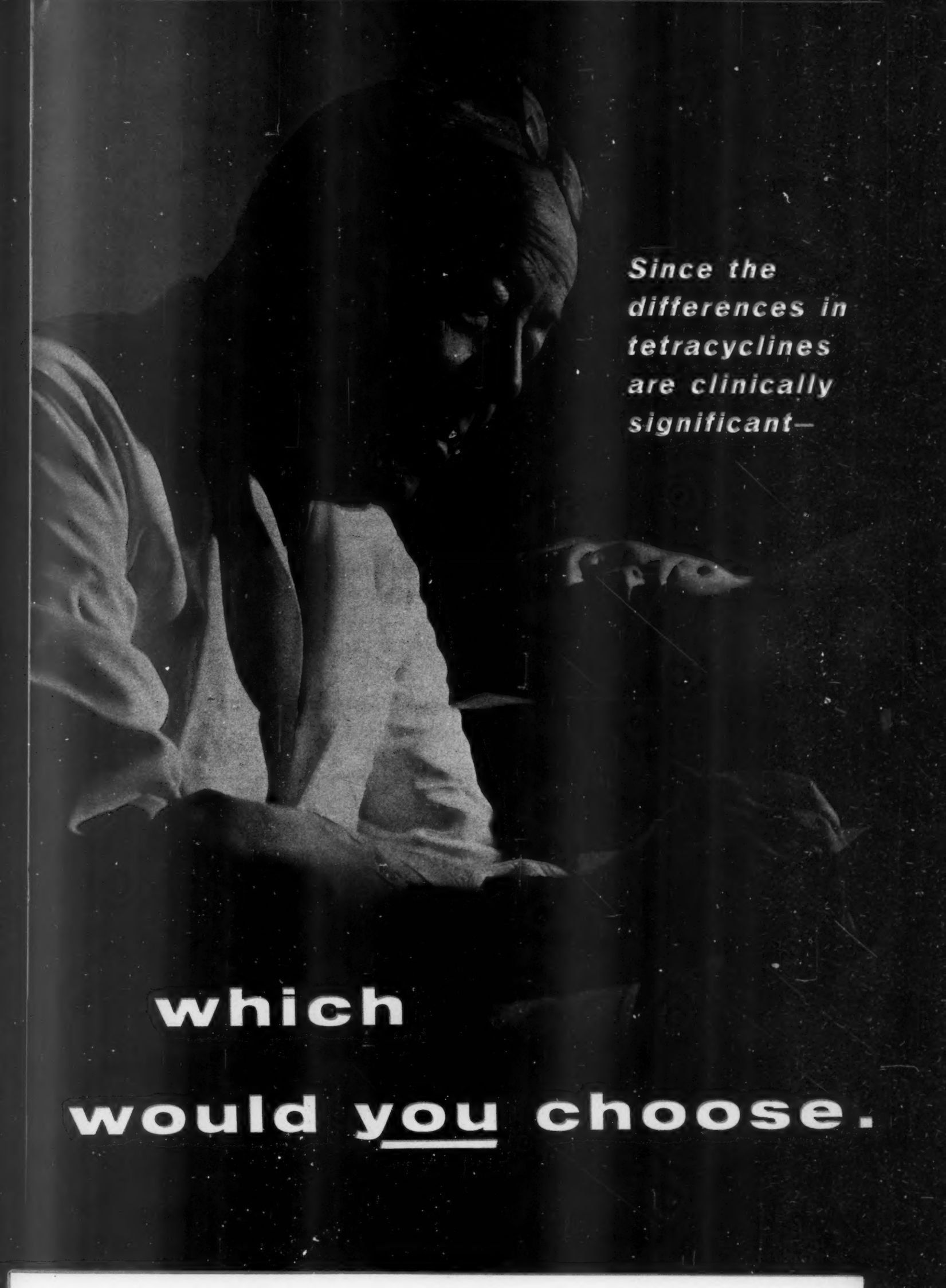
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Daily dosage of 4 capsules has ***sodium equivalent of approximately 900 mg. of sodium chloride***—contraindicated for many patients on restricted sodium intake.

Produces *less-than-highest* average tetracycline blood levels for 24 hours following 250-mg. capsule ingestion.

No clinical reports on b.i.d. dosage.

Pharmacodynamic action: **ANTIBIOTIC**
and potentially **EDEMATIGENOUS**

The differences are clinically significant

BRISTOL LABORATORIES INC. • SYRACUSE, N. Y.

"A to Z"

control of urinary tract infections

Azotrex™

CAPSULES

Comprehensive tetracycline-sulfonamide-analgesic action

AZOTREX is the *only* urinary anti-infective agent presenting the comprehensive "A to Z" effectiveness of:

	IN EACH CAPSULE
TETREX – the original tetracycline phosphate complex (tetracycline HCl activity)	125 mg.
SULFAMETHIZOLE – the sulfonamide of choice for urinary tract therapy, and	250 mg.
PHENYLAZO-DIAMINO-PYRIDINE HCl – highly regarded urinary analgesic	50 mg.

Minimum adult dose: 1 cap. q.i.d.

Indicated in the treatment of cystitis, urethritis, pyelitis, pyelonephritis, ureteritis and prostatitis due to bacterial infection. Also before and after genitourinary surgery and instrumentation, and for prophylaxis.

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Bristol
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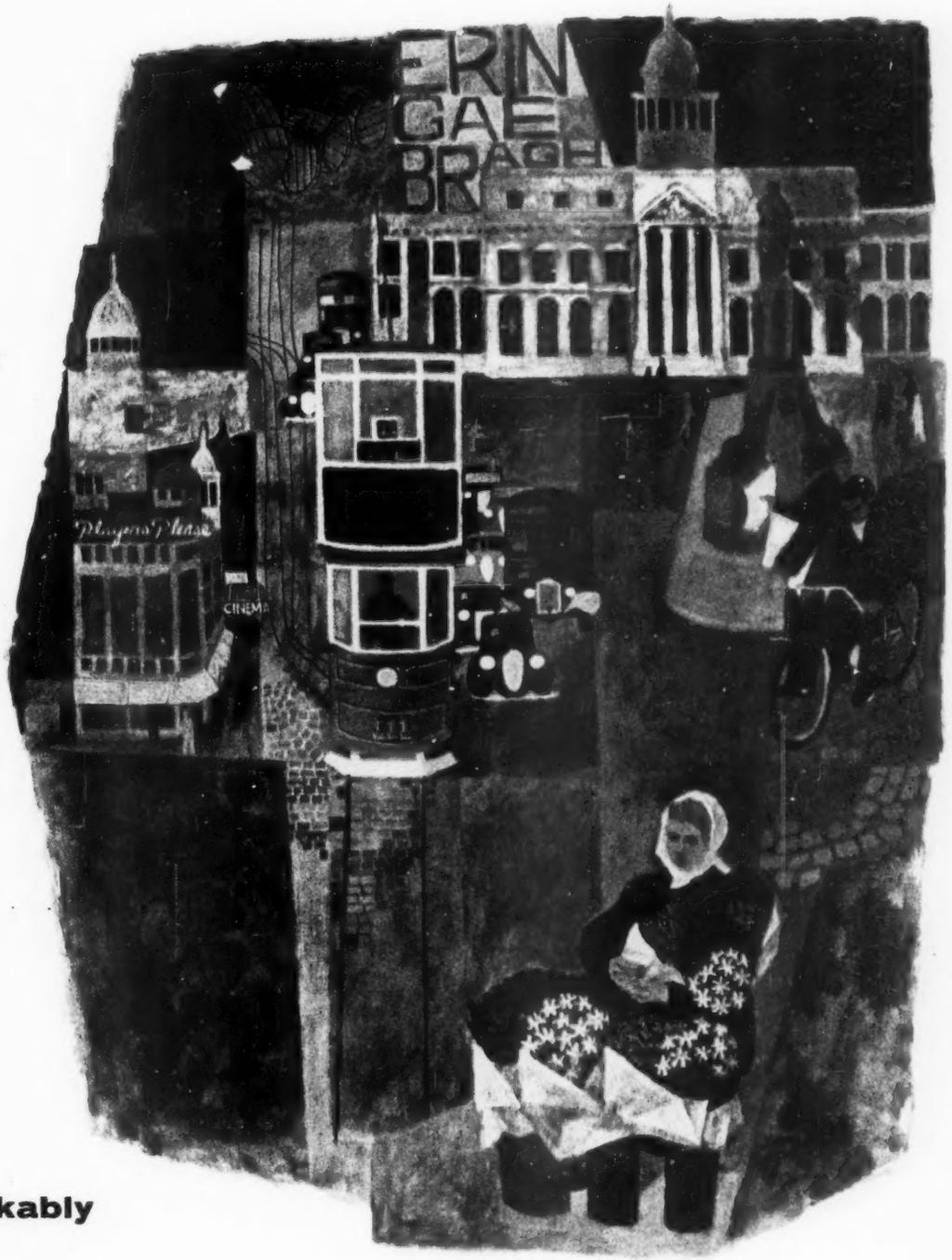
In Dublin, too,
Pentothal is used
almost constantly



Unmistakably

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With PENTOTHAL Sodium, there is no prolonged induction period. Recovery is smooth, rapid, because there is little drug to be detoxified. And PENTOTHAL is economical because the *total* dosage to achieve the desired levels of anesthesia is small. More than 2500 reports, covering every type of surgical procedure, have been published...over 23 years of use...where ever modern intravenous anesthesia is practiced. Abbott

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no memory...

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allows your young patients to go to sleep in the quiet of their own rooms, awaken there afterward with no memory of the events between . . . no preoperative apprehensions . . . no postoperative behavior problems

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reduces dosage of inhalation and supplementary agents, can be used as a basal anesthetic or as a sole agent in selected minor procedures

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conforms fully to the official standards prescribed by the U.S.P.

This prepacked, pretested material assures unquestionable sterility at time of use.

Especially-designed equipment impregnates the gauze so lightly and uniformly that the danger of maceration is minimized.

Most hospitals are neither staffed nor equipped to follow the U.S.P. XV specifications for the preparation and control testing of a dependably sterile petrolatum gauze. That is why 'Vaseline' Sterile Petrolatum Gauze U.S.P. is their choice of a nonadherent dressing. It has proved itself "best by test" in millions of cases in thousands of civilian as well as military hospitals throughout the United States.

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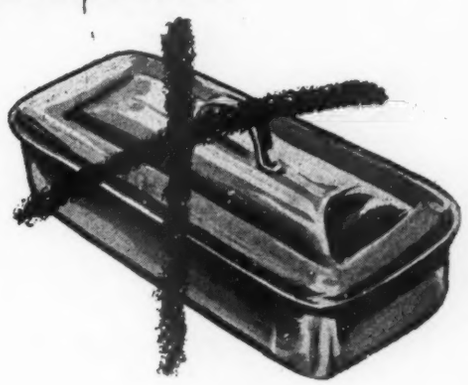
when this superior prepacked sterile product is available at a worthwhile saving?



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NEW YORK 17, N.Y.

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one dressing for both enzymatic debridement and healing action

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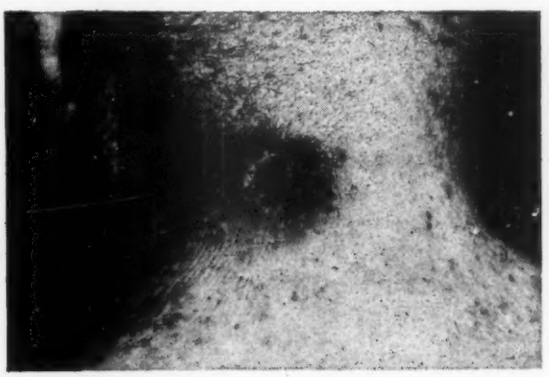
PANAFIL Ointment combines two essential functions for the local treatment of chronic ulcers, infected wounds and other resistant skin lesions. Gentle debridement with the proteolytic enzyme, papain, is complemente by the wound-healing action of chlorophyll derivatives. The greater safety of PANAFIL permits continuous dressings, which maintain a clean wound base until healing is complete.[1,2,3] The need for specific anti-infective medication is eliminated in most cases.[4]

PANAFIL Ointment contains papain powder 10%, urea U.S.P. 10%, and water-soluble chlorophyll derivatives N.N.R. 0.5% in a hydrophilic ointment base.

HEALING OF SEVERE CARBUNCLE WITH PANAFIL
Severe carbuncle on back of neck of 79-year-old man.
Left: Before incision and start of therapy.
Right: Lesion almost healed after two weeks of therapy with PANAFIL. Complete healing one week later.



PHOTOGRAPHS COURTESY OF W. C. BECK, JR., AND A. MARKERT, V. A. HOSPITAL, FT. HOWARD, MD.

References: (1) Miller, E. W.: New York J. Med. *56*:1446, 1956. (2) Garnes, A. L., and Barnard, R. D.: Angiology *8*:13, 1957. (3) Morrison, J. E., and Casali, J. L.: Am. J. Surg. *93*:446, 1957. (4) Wood, O. H.: Maryland M. J., in press.

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CATHETERS,
SOUNDS AND
CYSTOSCOPES:
SOURCES OF
INFECTION

before and after urologic instrumentation

during indwelling catheterization

prophylactically in urologic surgery

FURADANTIN®

brand of nitrofurantoin

"*The catheter* is probably the most common agent responsible for resistant urinary tract infections. . . . A catheter seeds the bladder with urethral bacteria."[1]

***During indwelling catheterization,* "the urethra is distended by a foreign body for days or weeks. The response to this is production of a sheath of mucopurulent exudate around the catheter, providing a splendid medium for growth of microorganisms. Infection of the bladder cavity is almost inevitable under these circumstances. . . ."[2]**

"*One further danger of urethral instrumentation* is that it may produce a transient bacteremia. . . . In view of the possibility that infection of the kidneys may take place via the blood stream, *the bacteremia of urethral instrumentation probably represents one of the ways in which infection is transferred from lower to upper urinary tract.* . . . Bacteremia has been found in a significant proportion of cases immediately after the passage of a sound or cystoscope."[2]

FURADANTIN

". . . may be unique as a wide-spectrum antimicrobial agent that is bactericidal, relatively nontoxic, and does not invoke resistant mutants."[3]

■ **RAPID ACTION.** FURADANTIN, a specific for urinary tract infections, provides rapid bactericidal action against a wide range of gram-positive and gram-negative bacteria and organisms resistant to other agents including Proteus and certain strains of Pseudomonas. "Nitrofurantoin (FURADANTIN) has been found to be highly effective in the treatment of chronic urinary tract infection following prostatectomy. Treatment resulted in an abrupt fall in the number of bacteria in the urine, and, in almost one half of the patients, sterile urines were obtained during treatment. The drug was most effective against infections with E. coli and B. proteus."[4]

■ **EXCELLENT TOLERANCE.** There have been no reports of injury to kidneys, liver or blood-forming organs as a result of FURADANTIN therapy. No cases of monilial superinfection, crystalluria or staphylococcic enteritis have ever been reported. In one study, a particularly encouraging finding "was the fact that nitrofurantoin (FURADANTIN) did not cause diarrhea in any of the patients. . . . This might be a consideration in the choice of an antimicrobial drug, particularly if the patient is in the hospital."[3]

■ **NEGLIGIBLE DEVELOPMENT OF BACTERIAL RESISTANCE.** In six years of extensive use in the treatment of genitourinary tract infections, development of bacterial resistance remains negligible with FURADANTIN.

AVERAGE FURADANTIN DOSAGE: In acute, complicated or refractory cases and in chronic infections of adults: 100 mg. q.i.d. In acute, uncomplicated urinary tract infections, for prophylaxis and postoperatively in urologic surgery: 50 mg. q.i.d. (If patient is unresponsive after 2 or 3 days, increase dose to 100 mg. q.i.d.)

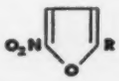
SUPPLIED: Tablets, 50 and 100 mg., bottles of 25 and 100. Oral Suspension, 25 mg. per 5 cc. tsp., 60 cc. bottle.

NOW for hospitalized patients, for severe urinary tract infections when peroral administration of Furadantin is not feasible and for serious infections as septicemia (bacteremia) when the bacterium is sensitive.

NEW, LIFESAVING **FURADANTIN** *Intravenous Solution*

FURADANTIN Sensi-Discs for bacterial sensitivity tests are available from Baltimore Biological Laboratories.

REFERENCES: 1. Lich, R., Jr.: J. Arkansas M. Soc. 52:271, 1956. 2. Beeson, P. B.: Yale J. Biol. 28:81, 1955. 3. Waisbren, B. A., and Crowley, W.: A.M.A. Arch. Int. M. 95:653, 1955. 4. Draper, J. W., et al.: J. Urol. 72:1211, 1954.



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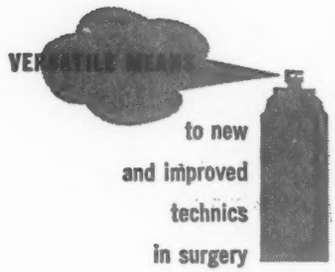


problem: **How to protect episiotomies from soilage and contamination.**

solution: **Dress with Aeroplast.®**

Sprayed directly over sutures, Aeroplast liquid surgical dressing conforms to the difficult contour of the wound area and forms an insoluble plastic film barrier against contamination. Postpartum care is simplified, early healing is encouraged. Flexibility of the dressing increases patient comfort.

Aeroplast plastic surgical dressing is a versatile instrument which the imaginative surgeon can use to solve other difficult or unusual dressing problems.

For successful use of Aeroplast, the aerosol container should be held at least 10 or 12 inches away from the area to be dressed. Then spray it on lightly —*just a swish over the wound*—and let it dry for 30 seconds. Apply two more times, still allowing sufficient time for drying and still at a distance of 10 or 12 inches. Don't expect to see a heavy, thick film. Three, light quick sprays form a film which, although transparent and barely visible, is an efficient surgical dressing and bacterial barrier.

If hemostasis is incomplete, a single layer of gauze may be placed along the incision while the first spray of Aeroplast is still sticky. Then continue technic as above.

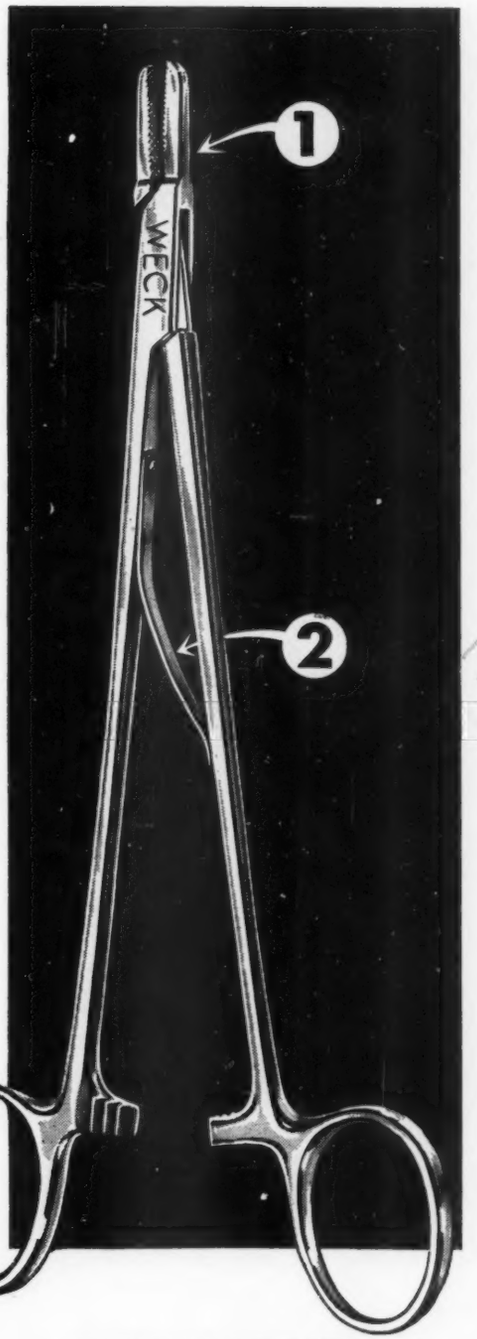
Use of Aeroplast in both operative and traumatic surgery has been widely documented. May we send you reprints and literature?

AEROPLAST CORPORATION, 420 DELLROSE AVENUE, DAYTON 3, OHIO

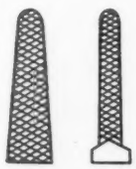
®AEROPLAST—*plastic surgical dressing*
BRAND OF VIBESATE

New-"RYDER" NEEDLE HOLDERS *with* 2 NEW EXCLUSIVE WECK FEATURES

These new, light-weight Ryder Needle Holders boast two new design improvements which, along with the famous WECK "Bulldog"* jaws, make suturing much easier, quicker and more efficient.



❶ NEW! UNIFORMLY NARROW JAWS



The narrower the jaw the less chance of bending or breaking the needle.

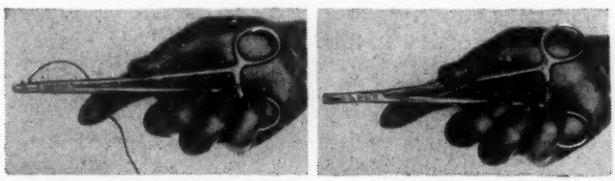
With the new *uniformly narrow* jaws (in contrast with the former *tapered* jaws) the surgeon need no longer be careful to grip the needle *only* with the very tip of the jaws. The result – a firmer grip on the needle and a more efficient, time-saving procedure.

❷ NEW! SPRING-ACTION HANDLE

The spring in the handle opens the jaws automatically (as shown below) as a light finger pressure releases the catch. This is a definite help to those surgeons who are using the increasingly popular palm-roll technique in suturing. There is no longer any need to use the finger rings to open the jaws.

The result – again a more efficient time-saving procedure with less hand fatigue.

New Ryder needle holders are available in 6", 7", 8" and 10" lengths.



***WECK "BULLDOG" MEANS A ONE PIECE JAW**

The serrated areas of Weck Needle Holder "Bulldog" jaws are hardened by a special process forming complex carbides to provide the exact hardness to resist wear, assure firm grip and yet not injure needles. These serrations are actually part of the jaws – *not an insert* – and are patterned to give the needle a tight fit in the grooves.

WECK

67 years of knowing how

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Manufacturers of Surgical Instruments • Hospital Supplies • Instrument Repairing

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SOLUBLE VITAMINS

HIGH POTENCY B COMPLEX + 500 MG. VITAMIN C

PARENTERAL

all in one vial

Instantly Soluble in any Standard Diluent

Just mix 5 cc. of any standard parenteral solution with a vial of PARLITE . . . it's ready for intravenous injection or infusion use. PARLITE may also be used intramuscularly . . . costs no more than multiple-vial preparations.

Each one-dose vial contains:

Thiamine HCl (B_1)	10 mg.
Riboflavin (B_2)	10 mg.
Sodium Pantothenate	10 mg.
Niacinamide	150 mg.
Pyridoxine HCl (B_6)	5 mg.
Vitamin B_{12}	25 mcgm.
Ascorbic Acid	500 mg.

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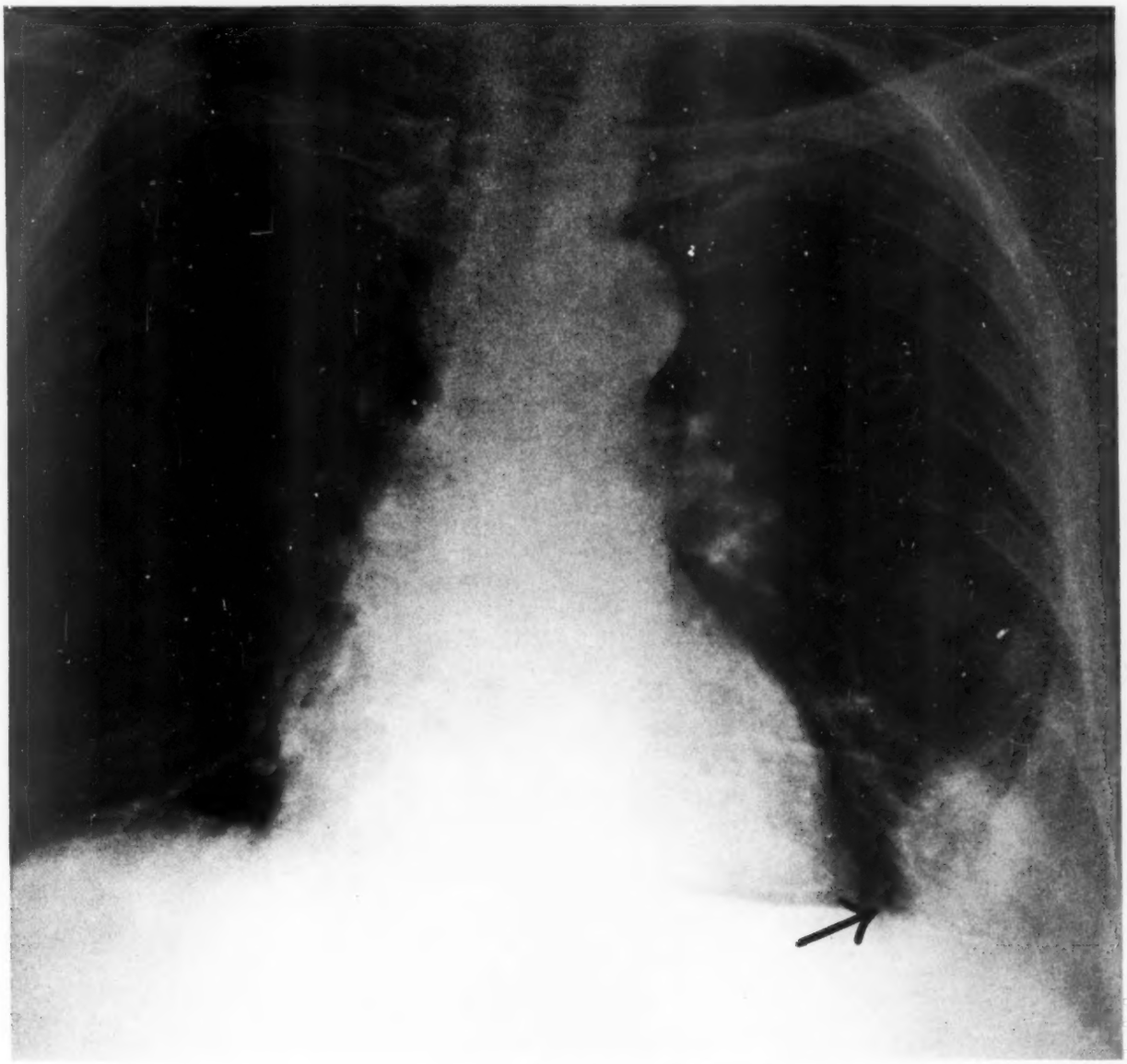
*REG. U. S. PAT. OFF.



EXCISION OF LIPOMA OF PARIETAL PLEURA: 1. Preoperative radiograph, A-P view, indicates presence of mass within pleural cavity.

Thousands can study this case...*over and over again*... ...*thanks to the radiographs and photographs shown here*

2. Excised Mass. Turn page for reproduction of laminagraph which locates the mass, together with color photographs of surgery.

It turned out to be a lipoma attached to the parietal pleura.

Here you see illustrated what radiologist, attending physician and surgeon saw . . . the radiographs which pin-pointed the mass, helped guide the surgeon's fingers when he removed it . . . plus photographs of the actual surgery.

With this material, physicians can review this case, use it in teaching, or research, or to illustrate a medical paper, a lecture or a scientific exhibit.

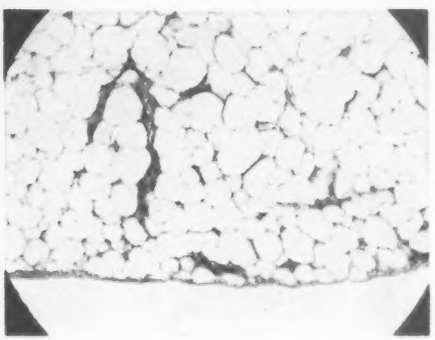
Truly, visual data such as this works the clock around to widen the scope of today's medical knowledge.

Kodak

3. Laminagraph establishes position of mass in chest. It also suggests its physical characteristics.

4. Left thoracotomy. Eighth rib is exposed.

5. Mass attached to left parietal pleura is exposed.



6. Photomicrograph of mass—a lipoma or fatty, benign neoplasm. (Magnification, X40.)

For Radiography: Kodak Royal Blue X-ray Film and Kodak x-ray processing chemicals meet the most exacting requirements. They are always dependable—uniform. Quality-controlled—rigidly tested—they are made to work together.

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Order x-ray products from your x-ray dealer, photographic products from your photographic dealer.

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An established systemic hemostat

Adrenosem®
SALICYLATE*

(Brand of carbazochrome salicylate)

effective in virtually every operative procedure

The reports of numerous investigators have established the effectiveness of Adrenosem Salicylate in the control of bleeding. It has been used prophylactically and therapeutically in virtually every operative procedure. Following are some of the procedures and conditions where its usefulness has been demonstrated:

Tonsillectomy, adenoidectomy and nasopharynx surgery
Prostatic, bladder and transurethral surgery
Excessive postpartum bleeding and uterine bleeding
Thoracic surgery
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Gastrointestinal bleeding

ALSO:
Idiopathic purpura
Epistaxis
Retinal hemorrhage
Hematuria
Hemoptysis
Familial telangiectasia
Pulmonary bleeding
Metrorrhagia and menorrhagia

*U.S. Pat. 2581850; 2506294

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One of the many uses of **adrenosem®**
SALICYLATE

Adrenosem Salicylate is useful in every operative procedure where bleeding and oozing are problems. This hemostatic agent controls blood loss by maintaining normal capillary permeability and by promoting the retraction of severed capillary ends.

One clinician states: "At the recommended dosage levels there are no contraindications. Patients treated for more than two years show no toxic effects attributable to the drug."[1]

Adrenosem Salicylate is supplied in

Ampuls
Tablets
and as a Syrup

1. Riddle, A.C., Jr.: Adrenosem Salicylate: A Systemic Hemostat, Oral Surg., Oral Med., Oral Path. 8:617 (June, 1955).

Vaginal hysterectomy.
Without Adrenosem. Note bloody field.

Vaginal hysterectomy.
With Adrenosem. Note dry field.

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References: 1. Gamble, J.R., et al. Arch. Int. Med. 95:52, 1955. 2. Gamble, J.R., et al. J. Lab. & Clin. Med. 42:805, 1953.

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another development by

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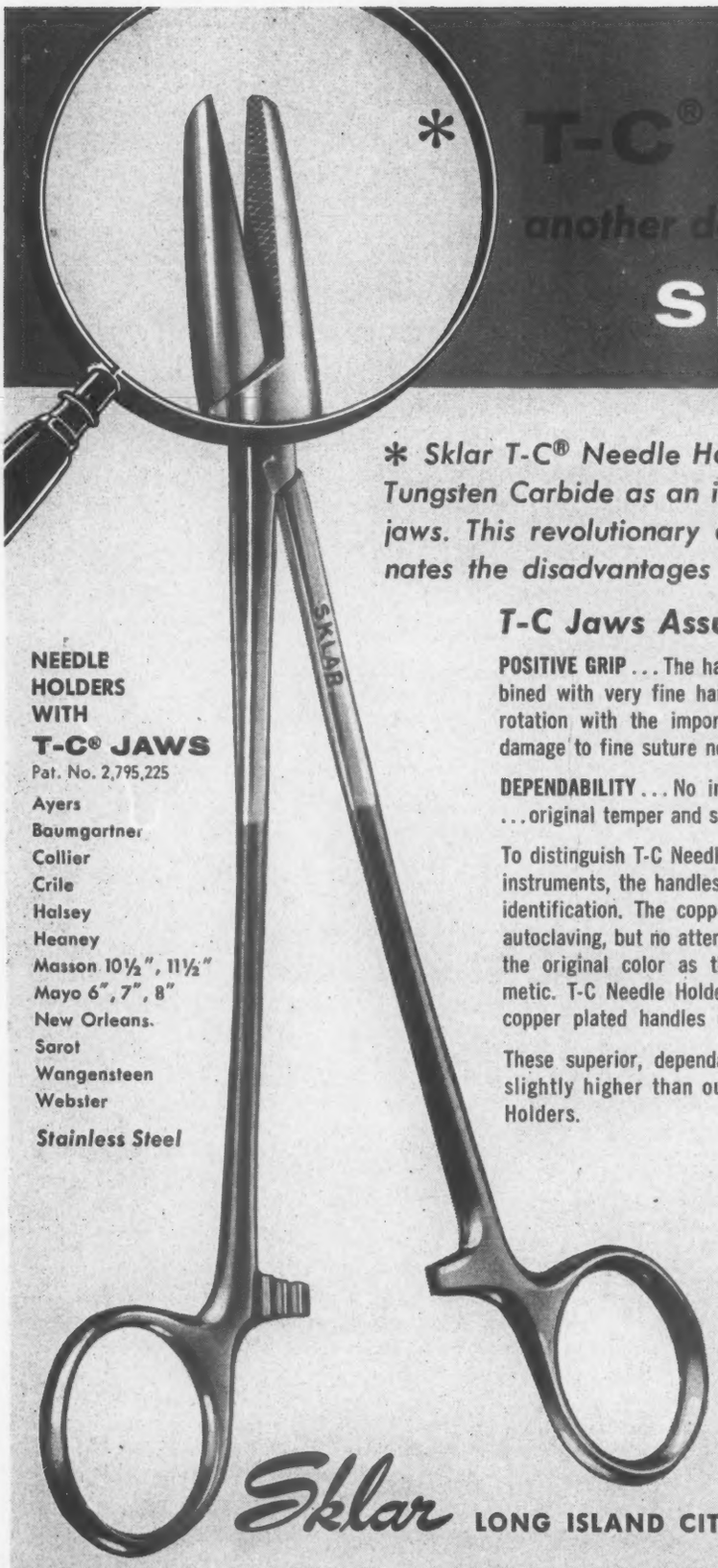

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POSITIVE GRIP ... The hard surface of the jaws combined with very fine hand filed serrations prevents rotation with the important advantage of avoiding damage to fine suture needles.

DEPENDABILITY ... No inserts to loosen or fall out ... original temper and strength of jaws is preserved.

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These superior, dependable instruments are priced slightly higher than our standard pattern Needle Holders.

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that have always served better
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When successful clinical management calls for dependable hemostasis and positive drainage, leading urologists and practitioners have long relied on ACMI Hemostatic Bag Catheters—characteristically superior in purity of latex and in every detail of construction. Rigid inspection assures accuracy in size and uniformity of inflation.
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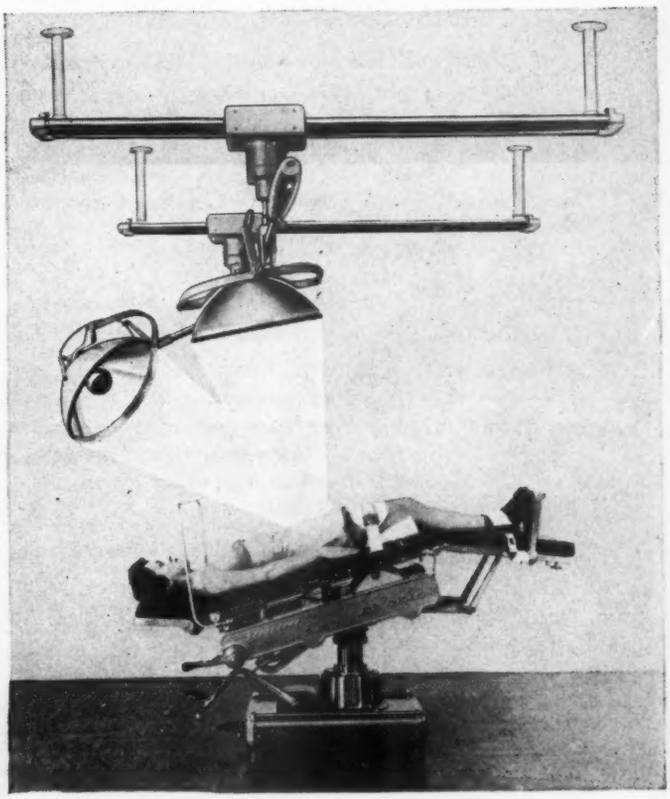

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catheterization . . . biopsy . . .
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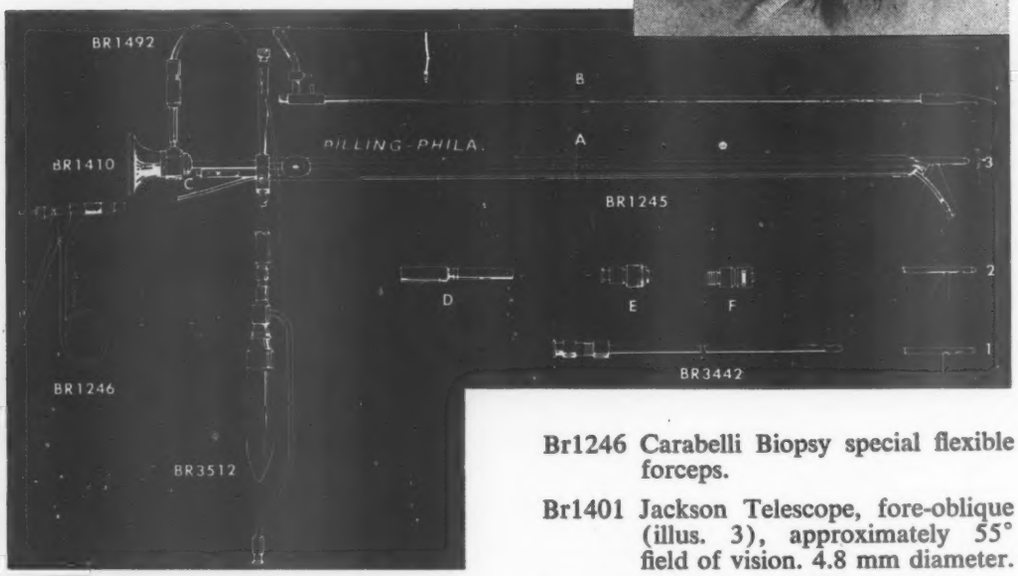
in all five lobes of the lung



Designed for A. Albert Carabelli, M.D
Trenton, N. J.

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Br1401 Jackson Telescope, fore-oblique (illus. 3), approximately 55° field of vision. 4.8 mm diameter.

Br1405 Same, retrospective (illus. 2).

Br1410 Same, right angle (illus. 1).

Br1492 Carabelli-Jackson Light Cord—holds cord up and away from the lumen permitting a clear field of vision for the bronchoscopist.

Br3442 Carabelli Bronchogram Catheter and Adapter with introducing Stylet.

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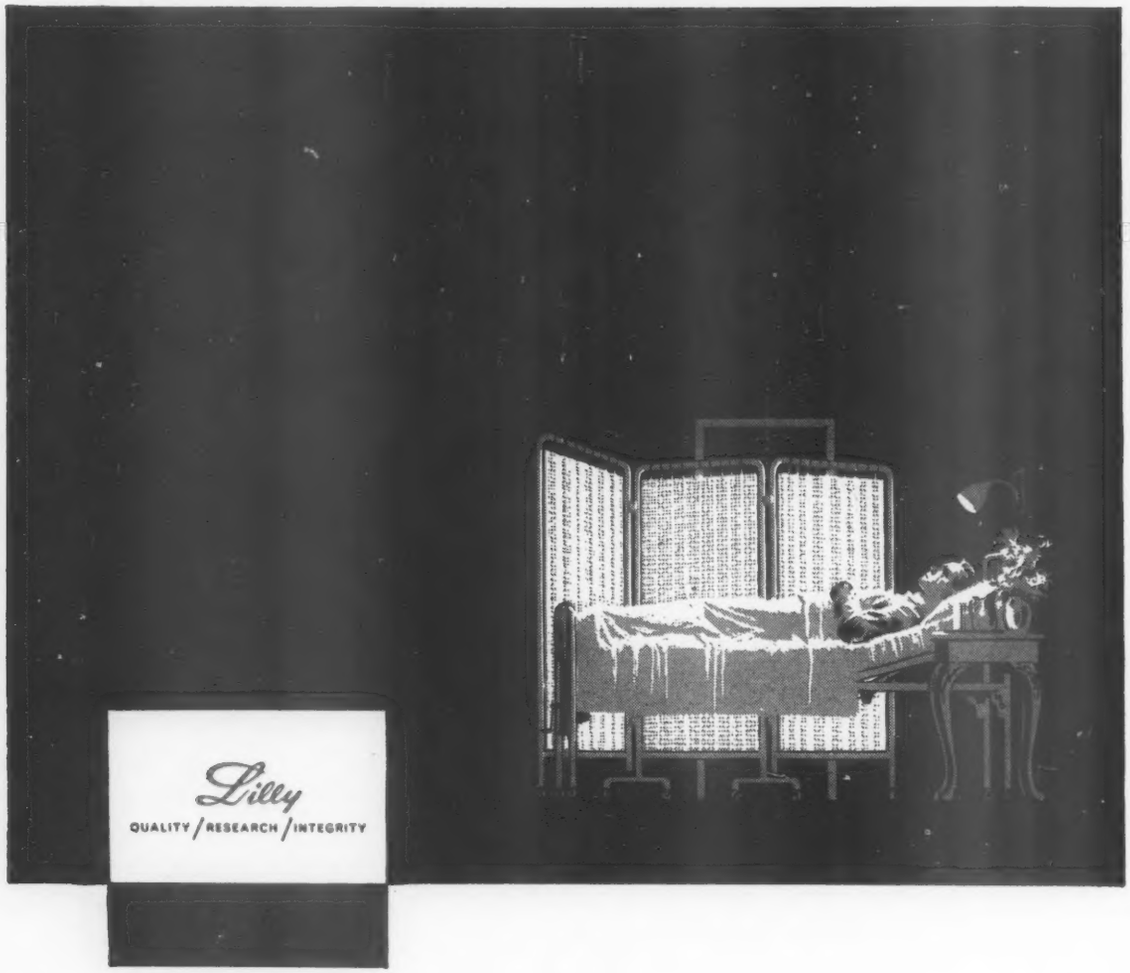

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The American Journal of Surgery

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EDITORIAL

Colpo-puncture

EXPLORATORY laparotomy has a place in abdominal and pelvic surgery and is occasionally justified to determine the operability or resectability of predetermined disease.

Exploratory pelvic celiotomy is otherwise seldom indicated and is to be considered a serious undertaking in young women; and when it is combined with meddlesome surgery of physiologic ovarian cysts as a justification for hastily advised surgery, it is to be deplored. Rarely is the need for pelvic laparotomy so urgent that the diagnostic procedures with which every gynecologic surgeon should be familiar cannot be used to establish a definite diagnosis.

Exploration of the pouch of Douglas by needle or trocar has now become established as a valuable aid in gynecologic diagnosis and is often indispensable in establishing the presence or absence of early or unruptured tubal pregnancy, small ovarian cysts, early and limited endometriosis and the results of residual pelvic inflammation. These are the conditions that account for a large percentage of the missed or incorrect diagnoses in women with pelvic or abdominal complaints.

Puncture of the posterior vaginal fornix into the peritoneal pouch permits aspiration of peritoneal fluids for laboratory evaluation as well as telescopic visual diagnosis for evaluation of these obscure gynecologic diseases.

Cul-de-sac puncture by needle or trocar is a minor diagnostic procedure that does not require general anesthesia or operating room facilities, and may spare the patient the inconvenience and expense of major surgery.

Many surgeons do not approve of cul-de-sac needling or trocar puncture. Those inexperienced in the technic suggest extreme caution and believe colpo-puncture to be hazardous. The published results of those who have had extensive experience with colpotomy do not justify this conservative attitude and indicate that cul-de-sac needling and culdoscopy are extremely valuable when used to solve these occasional difficult diagnostic problems.

When these diagnostic tools are skillfully employed, errors are prevented in both directions. The unruptured ectopic pregnancy may be identified before serious blood loss has occurred. Pelvic endometriosis may be accurately diagnosed while conservative surgery may still be effective. The patient with psychosomatic pain or distress resulting from abnormal or disturbed physiologic processes may be spared laparotomy.

Omission of these proved valuable diagnostic aids before fruitless surgical exploration for suspected gynecologic disease may be imputed to the pelvic surgeon as a reproach.

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New York, New York

Fatal Trauma As Seen in Suburban Hospitals*

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THE daily newspapers impress the public, as well as the medical profession, with numerous accounts of the fatal consequences of trauma. Since the victims mentioned in the headlines usually die instantly, or very soon, attending physicians are unable to treat such casualties to any extent. However, the injured patients who can be taken to the emergency rooms of hospitals for treatment are the responsibility of the profession. Some of these latter patients die although they apparently have adequate care. An investigation of this second fatal group was conducted and is reported herein.

A report of the study of fatal trauma serves several purposes: first, the readers should be stimulated to attend with greater interest patients with these types of trauma; second, the future management of patients in general sustaining trauma should be improved; third, there is thereby established a base line which can be used for comparison with future end results; and fourth, the results of such a study may be of value to civil defense and other agencies. For these reasons the etiologic factors involved in traumatic fatalities, the clinical courses of the patients injured and the available autopsy findings were examined. Suburban hospitals serve, for several reasons, as excellent locations for such an investigation.

Because of their increase in number and size since World War II, the suburbs are comparable to many of the smaller cities throughout the country. Their problems in regard to trauma may serve as indices in assessing this field nationally.

CLINICAL MATERIAL AND RESULTS

Through the kindness and assistance of the personnel of the record rooms of two hospitals in different suburbs of the metropolitan area of Chicago, over 100 clinical records of patients who died of trauma thirty minutes or more after hospitalization were analyzed. One of the hospitals, Hospital A, is located in Cook County. The other hospital, Hospital B, is situated in Lake County. Table I includes the type and number of each accident in this series. The fatalities occurred at Hospital B between February 18, 1950 and January 2, 1955, and at Hospital A between January 18, 1951 and December 21, 1952. In Table II are given the facts concerning the age and sex of this series of patients with fatal trauma.

Table III shows the classification of the significant injuries in this series. If a patient had two or more injuries, only the more serious one was listed. However, in Table IV are included the multiple injuries sustained by the patients as well as their incidence. Table V emphasizes the importance of craniocerebral and thoracic involvement in the patients with multiple injuries. As is true in other fields of medicine and surgery, the fatalities in this series were frequently due to one or more complications or other clinical entities. For this reason they are listed respectively in Tables VI and VII.

In a scientific evaluation of any fatal clinical condition it is advisable to correlate the findings of the postmortem examination with the clinical record. Unfortunately, there was a paucity of autopsy reports available for study. The facts concerning such examinations in this

* Presented in part at Annual Meeting of New York Orthopedic Hospital Alumni Association, May 11–12, 1956.

series are presented in Table VIII and will be discussed later.

Another survey was made of ten records of patients who died within forty-five minutes after admission to the emergency room of Hospital A. Some of the facts concerning this small series are given in Table IX. There were no autopsies performed on any of these patients.

TABLE I

Type of Accident	Hospital A	Hospital B	Total
Automobile	28	7	35
Fall at home	19	5	24
Pedestrian:			
Struck by auto	11	1	12
Struck by train or street car	2	1	3
Burned (at home)	6	1	7
Fall at work	3	2	5
Fall due to bad weather (ice, etc.)	3	1	4
Penetrating bullet wounds	3	..	3
Suicidal attempt	2	2	4
Assault	2	..	2
Motorcycle	1	..	1
Totals:	80	20	100

OBSERVATIONS

The results of this study confirm the well known fact that automobiles and trucks are causing an alarming number of deaths and serious injuries. In Table I it can be seen that approximately 35 per cent of the fatalities in this series were due to mobile vehicles; pedestrians were victims in over 15 per cent of the remaining cases. An important setting for fatal accidents has always been the home. In this series 31 per cent were due to falls and burns sustained in the home. Thus, the automobile and the home cause over 80 per cent of the fatalities due to trauma.

The importance of focusing more attention on the treatment of trauma in the aged is illustrated in Table II. Approximately 50 per cent of the patients in this series were over sixty. Except for the eighth decade, in which there were twenty-three patients, there was an almost uniform distribution of ten patients in the third through the ninth decades. In this study there were very few young females. Apparently they are better able to avoid fatal trauma. This is not true of the older members of this sex, for they frequently fall and sustain fractures of the hip.

CRANIOCEREBRAL INJURIES

As shown in Table III, approximately 40 per cent of the fatalities had as their significant injury one involving either the brain or skull or both. The average age at death was 44.7 years. George F. Strong [1], past President of the Canadian Medical Association, in an address on traffic accidents, made a pertinent statement concerning life years. (Lost life years are calculated by subtracting the age at death from the expected age of death for the individual. For example, if a man dies at sixty, although he has a life expectancy of seventy years, his premature death has resulted in the loss of ten life years.) In 1952, in British Columbia, heart disease was the leading cause (36.2

TABLE II

	Ages of Patients (by decade)										
	1st 0–10	2nd 11–20	3rd 21–30	4th 31–40	5th 41–50	6th 51–60	7th 61–70	8th 71–80	9th 81–90	10th 91–100	Total
Hospital A:											
Males	5	3	8	5	7	6	5	8	2	..	49
Females	..	..	2	..	2	3	3	11	8	2	31
Hospital B:											
Males	1	1	..	1	2	2	1	2	..	1	11
Females	1	..	..	1	..	3	..	2	1	1	9
Totals	7	4	10	7	11	14	9	23	11	4	100

per cent) of all deaths, but it represented only 12 per cent of the life years lost for all causes of death. Cancer, the second cause, accounted for 15.7 per cent of all deaths, but cancer was responsible for only 10.0 per cent of life years lost from all causes. Accidents, while ranking

TABLE III

Significant Injury	Hospital A	Hospital B	Total
Craniocerebral injury	35	3	38
Fracture, upper extremity of femur	16	3	19
Rib fractures and associated trauma	10	7	17
Severe thermal burns (60–85 per cent)	6	2	8
Penetrating wounds of abdomen	3	..	3
Multiple fractures	2	1	3
Penetrating laceration of neck	1	..	1
Multiple fractures of pelvis	1	..	1
Tension pneumothorax	1	1	2
Fractures of vertebrae:			
Cervical	1	..	1
Lumbar (first)	..	1	1
Multiple lacerations (suicide)	1	..	1
Fracture of clavicle, right	1	..	1
Fracture of humerus, left	1	..	1
Contusion of hip, right	1	..	1
Contusion of elbow, right	..	1	1
Rupture of thoracic aorta	..	1	1
Totals:	80	20	100

third in the cause of deaths (7.9 per cent), were first (17.5 per cent) in the number of life years lost. Less than one-third (29.0 per cent) of the patients with craniocerebral injuries in the series herein were over sixty years of age.

A survey of these patients with craniocerebral injuries revealed that over half of them were in shock on arrival at the hospitals. Although the patients were immediately treated for shock, some never recovered. Bowers [2] has shown a close correlation between shock, as evidenced by blood pressure drop, and case fatality rate in World War II. His data clearly demonstrate the necessity for correction of blood volume deficits as soon as possible in traumatic cases. Undoubtedly, more attention should be given to the management of shock and less to minor surgery in the emergency room. Oxygen was frequently given, utilizing the tent or mask method. Although shock and cerebral edema are partially corrected by oxygen therapy, these methods of its administration do not permit practical maintenance of a clear airway. An adequate supply of oxygen can be given by nasal catheter, or in a tracheotomy tube, and a clear tracheobronchial tree can be maintained simultaneously. Thus, shock and cerebral edema can be treated and the development of the traumatic wet lung [3] prevented.

A scrutiny of the records revealed that approximately one-half of these patients, according to their signs and symptoms, had the so-called traumatic wet lung syndrome. There were very few tracheotomies and these were not performed during the early hours of hospitalization. A few of the patients had additional injuries involving the nose and face with bleeding into the upper respiratory tract. An attempt was usually made in these cases to clear the mouth and pharynx. However, in the entire series there was only one bronchoscopy performed. The anesthesia service, in several instances, passed an endotracheal tube and aspirated secretions, blood etc., with a lessening of dyspnea and temporary improvement of the patient's condition. However, all of the procedures utilized did not prevent the development of pulmonary complications in a number of patients in the craniocerebral group. Better management of the patient in shock with more attention to maintaining an adequate airway and a sufficient intake of oxygen should decrease the number of deaths due to all types of serious injuries and especially those of the craniocerebral group.

Close examination of the clinical records disclosed a very limited number of lumbar punctures. These were usually performed by the attending neurosurgeon. Only a small amount of cerebrospinal fluid (10 to 20 cc.) was usually removed. Several patients who had an elevation of the cerebrospinal fluid pressure demonstrated improvement after such a procedure. A. Price Heusner, Professor of Neurosurgery at the University of North Carolina [4], recently informed me regarding his present concepts of the use of lumbar punctures in the management of head injuries: "(1) L.P. is now, in my view, a 'diagnostic' tool rather than a therapeutic technique in head injuries. (2) L.P. is made on most, but not all acute cases; if the diagnosis is evident without L.P., this is omitted. (3) L.P. is not without danger, notably 'the drawing

home' of a temporal lobe pressure cone, and should not be made if signs of this complication exist." Undoubtedly, cerebral edema and congestion, and contusions and lacerations of the brain can be better diagnosed through the judicious use of lumbar punctures. Further management can then be governed according to the results of these procedures.

If more autopsies had been performed, a better understanding of the causes of death in the patients with craniocerebral injuries would have resulted. Certainly confirmation of the clinical diagnoses such as cerebral edema, contusion of the mid-brain and basal skull fracture could be made. For example, Dr. Donald Munro [5], Surgeon-in-Chief for Neurological Surgery at the Boston City Hospital, was able, through the cooperation of Dr. Timothy Leary, one of the medical examiners of Suffolk County, Massachusetts, to learn more about the causes of death and the pathology of fatal craniocerebral injuries. Correlation of autopsy findings and the clinical course of the patients who have fatal injuries to the head should result in better treatment in the future of patients with such injuries.

HIP FRACTURES

There were nineteen patients who had fractures of the upper extremity of the femur. All except one were elderly women (average age, eighty-two years). Probably more of this group would have survived this type of injury had more attention been paid to the cardiovascular and pulmonary systems. At least four of the group were said to have died of cardiac failure. Two had cerebrovascular accidents, and one probably died of cardiac arrest in the operating room. It is unwise to promulgate the idea that all patients of the elderly age group with fractures of the femur should be given digitalis rapidly, although personal experience with this routine has been justified. Very few patients in this series received digitalis, and then only after several days of hospitalization.

At least nine of the patients had bronchopneumonia, a frequent complication of the elderly hospitalized patient. This was a clinical diagnosis in many cases, as thoracic roentgenograms were infrequently taken. Postmortem examinations would probably have confirmed this diagnosis. Only two autopsies were performed in this series. In other cases, permission from the family for such an examination had been obtained but the examination was apparently not authorized by the coroner's office. According to laboratory determinations, uremia was present in four cases.

Eleven patients of this group with fractures of the femur underwent surgery. The usual procedure was open reduction with internal fixation. Various types of internal fixation were utilized; the Smith-Petersen nail was used most often. Nine of the patients were operated upon after twenty-four hours of hospitalization. Too much delay probably increases the number of complications. The policy of early surgery, if possible, and early mobilization without weight bearing has produced lower morbidity and mortality rates. One patient did not undergo surgery for nine days. In this case the operation was apparently postponed because of a previous cerebrovascular accident and anemia.

One pertinent observation concerning this series of patients is that none were clinically in shock when first seen. The recorded blood pressure and pulse readings at the time of the initial examinations confirm this. Thus, shock is not a good excuse for delayed operation in this group. A more aggressive approach consisting of consultation with medical colleagues and rapid administration of digitalis plus earlier surgery is advocated in the elderly patient with a fracture of the hip.

RIB FRACTURES AND ASSOCIATED TRAUMA

There were seventeen patients who had fractures of one or more ribs. One of two additional patients with a unilateral tension pneumothorax did not have a rib fracture. Fourteen patients of this group had multiple (three or more) fractures of the ribs. Cameron, O'Rourke and Burt [6] have reported the importance of good management of these conditions. Another group has stressed the significance of the fractured rib [7].

Unilateral tension pneumothorax was present in two patients. A thirty-two year old man died eleven hours after admission; the diagnosis was made at the postmortem examination when air escaped under pressure as the left pleural cavity was opened. During hospitalization this patient had stated that he could not breathe, but nothing was done to determine the cause of his dyspnea. The other male patient, who died less than five hours after admission, was thirty-seven years old. In the first case a consultant recommended no interference. In the

second, a single aspiration of the involved pleural space was performed. Both of these young men might have been saved by proper diagnoses and management.

The average age of the patients in this group was fifty-five. Ten of the patients were in shock when first seen. At least half of the patients in the rib fracture series apparently had the traumatic wet lung syndrome. When first seen, four of these were in shock. This state is one of the etiologic factors in the development of the traumatic wet lung.

Fifteen patients died in less than seventy-two hours; the average period of hospitalization was twenty-three hours. The seriousness of thoracic injuries in civilian life is emphasized by the short duration of life in these patients after injury. In addition to shock, fourteen had associated injuries to the head. Thus, it is very important that patients with both types of injury be managed very carefully. The significance of adequate oxygenation of the lungs and brain in this group cannot be overemphasized. Likewise, the early use of tracheotomy in certain cases is recommended.

The older age group apparently does not tolerate trauma to the thorax very well. Nine patients were over sixty years of age. There were two cases of cardiac failure in patients sixty and seventy-five years of age, respectively. Three weeks after admission to the hospital a seventy-one year old woman died of cardiac failure and uremia. Elderly patients with thoracic injuries should be mobilized in the hospital as soon as possible. They should not be confined to bed unless absolutely necessary.

Only five of the patients (approximately 30 per cent) in this series had postmortem examinations. The autopsy protocols in the clinical records were revealing, especially as to pathologic conditions of the tracheobronchial tree and the lungs. As was previously mentioned, a tension pneumothorax was found in one and a large clinically unrecognized pulmonary embolus in another. Two others demonstrated the pathologic condition of the traumatic wet lung syndrome.

BURNS

There were eight patients who died of severe thermal burns. The burns were calculated as covering the following percentages of the body surface: 80, 70, 70, 80 to 85, 75 to 85, 50, 85 and 60. Two patients were four years of age or younger. Two were in the sixth decade of life and four were sixty-five years of age or older. Seven of the burns occurred in the home; one was the result of an automobile accident. Five of the patients were females.

Six of those patients burned were in shock when first seen and they did not recover from this state. Seven of the eight died within thirty hours after admission to the hospital. Their average period of hospitalization was thirteen hours. Although four of this small series received oxygen therapy (one by tent and three by nasal catheter), four apparently did not. There were respiratory tract complications in three patients. In two patients the nasal airway was blocked by dried blood, and in a third apparently a traumatic wet lung syndrome developed.

All of the patients were treated immediately with vaseline gauze and pressure dressings to the burned areas. Some débridement was done in several cases. They all received plasma intravenously, and whole blood also was given to four patients. Morphine sulphate was usually given for pain but the dosage seemed small in several cases considering the patient's age and the burned area. Judicious use of morphine is indicated to prevent respiratory depression, especially in elderly patients and those with pulmonary disorders. Serial hematocrit, red blood cell counts and hemoglobin determinations were performed in at least three cases. According to the two-hour laboratory determinations in one patient, the replacement therapy was inadequate. Thus, one concludes that the severely burned patient is a therapeutic problem that has not been completely solved by modern surgery and medicine.

PENETRATING WOUNDS OF THE ABDOMEN

There were only three patients, two of them male with an average age of forty-nine, with multiple penetrating wounds of the abdomen. The wounds resulted from small missiles. In two patients severe shock was present on admission; it developed shortly in the third. Surgery was performed in each case with closure of perforations and resection of the small bowel, stomach, gallbladder, or ovary when necessary. Two of the patients received 11 pints of blood each, and the third 36 pints.

Two patients lived less than forty-eight hours and one lived twelve days. No autopsies

were performed on these patients. One patient underwent bronchoscopy for bilateral lower lobe atelectasis. One other patient had terminal atelectasis which involved the entire left lung and must have been the main cause of death. According to these cases, shock and respiratory tract complications are two of the serious problems in the management of multiple penetrating wounds of the abdomen. In this regard postmortem examinations probably would have revealed more information.

TABLE IV

Multiple Injuries	Hospital A	Hospital B	Total
Craniocerebral and multiple fractures	10	1	11
Craniocerebral, thoracic injuries and fractures	9	5	14
Rib fractures and multiple fractures	3	..	3
Craniocerebral and multiple lacerations	4	..	4
Craniocerebral and fractures of vertebrae	2	..	2
Tension pneumothorax and craniocerebral	2	..	2
Penetrating laceration of neck and thorax	1	..	1
Penetrating wounds of skull and abdomen	1	..	1
Craniocerebral injury and dislocation of left shoulder	1	..	1
Rib fractures and hemopneumothorax	..	2	2
Tension hemopneumothorax and fractures	1	..	1
Rupture of aorta, hemopericardium, hemothorax and multiple fractures	..	1	1
Totals	34	9	43

MULTIPLE INJURIES

The problems of multiple injuries are indeed present in suburban and smaller city hospitals. This is well demonstrated in Table IV where forty-three cases are listed. It is significant that craniocerebral injuries were present in 81.4 per cent of the patients, and thoracic injuries were associated with other types of trauma in 53.5 per cent. Future management of trauma must continue to recognize the seriousness of these two categories of injuries. General suggestions as to their treatment have been made previously herein. However, the relatively high mortality rate in the multiple injury group justifies a better approach in the future. Table V shows that 76.7 per cent of the patients with multiple injuries had fractures or dislocations (rib fractures are excluded from this calculation). The injured patient is probably best managed by a surgeon who is experienced and interested in trauma. There is a mistaken idea by some members of the medical profession that injured patients do not need to be treated by experienced surgeons trained in the treatment of trauma. The results of this study certainly emphasize a need for management by experienced personnel.

TABLE V

Multiple Injuries	No. of Cases	Per cent
Craniocerebral involvement	35	81.4
Fractures and dislocations (excluding rib fractures)	33	76.7
Thoracic structures involved	23	53.5

TABLE VI

Complications	Hospital A	Hospital B	Total
Traumatic shock	34	11	46
Traumatic wet lung	27	7	34
Pneumonia (broncho or lobar)	17	3	20
Cardiac failure	9	..	9
Uremia	9	..	9
Pulmonary atelectasis	8	4	12
Cerebral edema	6	..	6
Acute toxemia (burn cases)	6	2	8
Upper respiratory tract obstruction	3	3	6
Decubitus ulcers	3	..	3
Delirium tremens	3	..	3
Cerebrovascular accident	3	..	3
Pulmonary embolism	2	2	4
Crush syndrome	2	..	2
Paralytic ileus	1	2	3
Infarct of kidney	...	1	1
Embolism, peripheral vessel	...	1	1
Cardiac arrest	1	..	1
Coronary occlusion	1	..	1
Totals	136	36	172

COMPLICATIONS

A number of the complications listed in Table VI have been referred to in the discussion of multiple injuries. Their prophylactic and therapeutic aspects have been mentioned. A list of the clinical conditions affecting the deaths in this series is given in Table VII. Certain statistics are significant. Shock was present in almost half (46 per cent) of the cases. Pulmonary complications were greatest in number, seventy-six to be exact, and included were traumatic wet lung, pneumonia, atelectasis, obstruction of the airway and embolism. Apparently more attention must be centered on prophylaxis of these complications. Cardiovascular complications totaled sixteen. The surgeon must be cognizant of these also. Central nervous system and renal complications numbered nine and ten, respectively. Avoidance of pulmonary and cardiovascular complications naturally reduces the number of complications in other systems.

TABLE VII
CLINICAL CONDITIONS AFFECTING DEATHS DUE TO TRAUMA

Clinical Condition	Hospital A	Hospital B	Total
Senility or arteriosclerosis	26	5	31
Obesity	4	3	7
Pulmonary emphysema	..	2	2
Diabetes mellitus	2	..	2
Toxic nodular goiter	..	1	1
Bronchial asthma	1	1	2
Secondary anemia	1	1	2
Varicose veins	1	..	1
Totals	35	13	48

POSTMORTEM EXAMINATIONS

"Those who dissected or inspected many bodies
Have at least learned to doubt
When others, who are ignorant of anatomy
And do not take trouble to attend to it are in no doubt at all."—Morgagni

Denny of India [8] prefaced his interesting article on the causes of death due to trauma with this quotation. As Professor of Forensic Medicine he knows the value of postmortem examinations in fatal trauma as well as in other deaths.

In Table VIII are shown the differences between the percentages of autopsies performed in cases of trauma in two well known Illinois counties. In Lake County, the coroner (Illinois law does not require him to have medical training) cooperated with the pathologist and other members of the medical staff in almost half (45 per cent) of the cases of fatal trauma. In Cook County, the coroner, who is also a layman, or his representative failed to cooperate in having autopsies performed on most of the fatally injured. Frequently approval for such an examination had been obtained from the family by the attending physician or surgeon, but the coroner's office did not authorize the examination.

TABLE VIII

	Hospital A	Hospital B	Total
Deaths (due to trauma)	80	20	100
Autopsy notes (in clinical record)	7	9	16
Percentage	8.7	45	16

It is only through complete postmortem examinations that the extent and effects of trauma can be seen. Certainly such examinations would result in better comprehension by the pathologist and attending physician of the true cause of death as well as the actual complications in the fatally injured. Future management of the injured would be improved as a result of this knowledge.

FATAL TRAUMA IN THE EMERGENCY ROOM

Table IX, which includes facts concerning ten patients who died of trauma within forty-five minutes after arrival at the hospital, is included to focus more attention on the early management and transportation of the injured as well as their immediate treatment in the emergency room. Most of these patients must have died of complications, namely, traumatic shock and obstruction of the respiratory tract, as well as their injuries.

Can anything be done to improve the mortality rate in this group of patients? Possibly the first aid which the patients received was not always the best. In the military services trained enlisted men have been taught to give dextran, or other reliable blood substitutes, in the cases

TABLE IX

Type of Accident	Age of Patient*	Significant Injury	Time Elapsed after Admission† (min.)
Pedestrian (struck by auto)	4 yr.	Craniocerebral	3
Pedestrian (struck by auto)	64 yr.	Craniocerebral	5
Passenger in automobile	7 mo.	Craniocerebral	10
Was shot attempting "hold up"	18 yr.	Penetrating wounds of chest	25
Run over by truck	49 yr.	(?)Multiple fractures	32
Automobile accident	66 yr.	Craniocerebral plus fractures	30
Automobile accident	27 yr.	(?)"Broken neck"	30
Automobile accident	37 yr.	(?)Craniocerebral	3
Truck accident at work	39 yr.	Craniocerebral	44
Automobile accident	90 yr.	Multiple, chest and head	5

* Average age, 39.5 years.
† Average time, 18.7 minutes.

of shock. Possibly police officers and other personnel connected with civilian ambulances also should be given this training. The importance of proper positioning of the patient and maintaining a clear airway, if possible, during transportation should be further emphasized.

One of the latest editions of the "Handbook for Boys" [9], published by the Boy Scouts of America, stresses the need for oxygen (or fresh air) but the need of maintaining a clear airway is not mentioned (13,925,000 copies of this manual have been printed since 1910). One of the latest American Red Cross First Aid Textbooks is even less specific about the need for an adequate passage of air to the lungs [10].

Some of the aforementioned suggestions concerning the treatment of shock and prevention of pulmonary complications should be followed more closely in the emergency room. If possible, upright portable thoracic roentgenograms of patients with injuries to the chest should be taken in the emergency room, especially if dyspnea or cyanosis is present. Apparently tension pneumothorax should be suspected and treated more often. The same is true of hemothorax and pneumothorax as well as the traumatic wet lung syndrome. As early as possible, a surgeon interested and trained in trauma to the thorax should see patients with these conditions. This is as important as early evaluation of the patient with craniocerebral injuries by a surgeon trained in their management.

One observation made during this study was the paucity of information concerning vital signs (blood pressure, pulse, respirations and state of responsiveness) of the patients seen in the emergency room. Every patient who was seen in this department had a single-page form with pertinent data as to address, nearest relative, etc., but the space given to the diagnosis, treatment, etc., was limited. It would seem wise to have a form for recording regularly the vital signs from the time the patient arrives at the hospital. Such data, plus the significant observations, are of value in making decisions concerning major surgery and other forms of therapy. This new form should be made a part of the permanent clinical record.

SUMMARY AND CONCLUSIONS

1. A study of over 100 clinical records of patients sustaining fatal trauma has been made in the hope that results will be of value in assessing some of the present problems in the field of trauma.

2. The increasing importance of the role of trauma and its management in the elderly is stressed.

3. Observations and suggestions have been made concerning the treatment of significant and multiple injuries.

4. There is a need of proper laws governing postmortem examinations in the fatally injured in some states.

5. Some recommendations are made concerning the teaching of first aid and the early treatment of the injured.

6. The blood pressure, pulse, respirations and state of responsiveness in the severely injured patients should be recorded at regular

intervals in the emergency room on a form which can become a part of the permanent clinical record of the patient.

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Guide to Medical Writing. A Practical Manual for Physicians, Dentists, Nurses, Pharmacists. By Henry A. Davidson, M.D., Editor, *Journal of the Medical Society of New Jersey*. 338 pages, with an index. New York, 1957. The Ronald Press Co. *Price* $5.00. (Although many books have been written on this subject, we hope the great majority of author-physicians will obtain a copy of Davidson's work. Also recommended are Fishbein's standard work and the recent "The Physician-Writer's Book" by Richard M. Hewitt, A.M., M.D.)

Cancer of the Esophagus

SURGICAL EXPERIENCE IN 101 RESECTIONS FROM 1948 TO 1955

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THIS paper, containing our results during the last six years in the surgical treatment of esophageal carcinoma in its different locations, may be of interest to interns as well as to surgeons.

During the period 1942 to 1948 we went through experiments and efforts from a technical point of view, operating upon patients in precarious conditions without any trained team or firm directions. (Table I.) The results were evidently poor. Nevertheless, in our department of the Instituto de Cirugía de Haedo, with our first assistant, Dr. A. G. Russo, some of the earliest esophagectomies in Argentina, followed by immediate operative success, were performed.

This table conveys an idea of this training period when surgery of the esophagus was still fully in development in our country. In 1948 one of us (Dr. Gil Mariño) took charge of the esophagus department, and little by little the technics were systematized. Through all this we got the necessary experience to face the new period analyzed herein.

Any patient with a tumor which occupies the upper and cervical esophagus does not survive the operation more than one year, so it seems to us that in these locations radiotherapy combined with intubation is indicated, excepting the small, operable tumors located at those points. The result of surgery on tumors of the lower esophagus is quite different, especially on those that are strictly esophageal. In our first period, only one patient who underwent resection in 1943 was living in 1951. In the second recent period, three patients are surviving more than five years, eight between five and three years, and a larger more recent number, less than two years. (Table II).

In 1948 to 1949 five gastrostomies were performed.

In Table II we do not differentiate between general hospital and private clinic treatment, nor was there any previous selection of the patients to be submitted to intervention. The high percentage of resections (91.8 per cent) evidently shows that many were advanced cases benefiting only by palliative resections.

TABLE I
FIRST PERIOD 1942–1947

	No. of Cases
Not operable (unexplored)	12
Explored	30
Resected	18
Gastrostomies	10
Total:	70

CANCER OF THE CERVICAL ESOPHAGUS

Of a total of 226 neoplasms of the esophagus examined, we only observed three cases with a strictly cervical location. In one case only could operation be tried. We practiced the cervical esophagectomy, followed by a skin plastic procedure according to the technic of Wookey modified by Sweet. The intervention was technically successful, but the patient died five months after the plastic procedure was finished and ten months after the first operation.

After our present experience we would indicate the operation of Wookey only on aged patients or poor risk patients who would not tolerate an important cervicothoracic intervention. If another operable case should come up, we would choose resection, if possible, followed by esophageal or subpharingogastric cervical anastomosis. The intervention should always begin with exploratory cervicotomy. If

TABLE II
SECOND PERIOD: 1948 TO AUGUST 1955

Year	No. of Cases	Not Operated	Thoracotomies	Resections	Alive	Dead	Palliative Therapy
1948	11	5	6	2	I.*2	..	2
1949	13	6	7	7	I. 2	1	..
					S.†1	3	..
1950	19	6	13	11	I. 4	2	2
					S. 1	4	..
1951	31	6	25	24	I.11	3	..
					S. 5	7	1
					C.‡1	1	..
1952	27	8	19	18	I. 6	1	..
					S. 1	5	1
					C..	2	..
1953	19	7	12	12	I. 4	..	..
					S. 3	5	..
1954	18	7	11	10	I. 4	1	..
					S. 2	1	1
					C. 1	..	..
1955 (to August)	26	9	17	17	I. 9	1	..
					S. 3	2	2
Total	164	54(32.9%)	110(67%)	101(91.8%)	I.42	9(17.6%)	4
					S.16	27(62.7%)	5
					C. 2	3(60%)	..

* I. = infra-aortic cancer.
† S. = supra-aortic cancer.
‡ C. = cervical cancer.

the tumor is resectable, we would proceed with a left-sided bicostal thoracotomy, employing the technic used for the treatment of carcinomas of the upper thoracic esophagus from the left, as we shall see herein.

CANCER OF THE UPPER THORACIC ESOPHAGUS

Two locations must be considered at the upper esophagus: the supra-aortic and the retroinfra-aortic or "mid-thoracic" carcinoma.

The technical problems both of them present are different. The resection of the supra-aortic tumors has to be followed by esophagogastric cervical anastomosis. The stomach will be brought up to the throat, which is the only way of reaching the end of the esophagus free from tumoral dissemination. There are still two possibilities to be considered as to this location. The one stated would be applied to a strictly supra-aortic carcinoma, but sometimes such tumors become thoracocervical, extending from the supra-aortic region to the intermediate cervicothoracic sector.

In the presence of these latter tumors we decide our procedure as follows. If the x-ray examination indicates that the tumor is more thoracic than cervical, we explore it by thoracotomy; but if we decide that it extends more to the cervical esophagus, we apply cervicotomy.

Ways of Entrance. The universal left-sided or "equidistant" thoracotomy at the sixth rib is not sufficient for all steps of total resection of the thoracic esophagus, necessary with supra-aortic or cervicothoracic cancers. If a lower entrance is chosen (at the eighth rib), it will be difficult to execute the high steps (mobilization of the aortic arch, liberation of the esophagus and anastomosis) if it can be done intrathoracically. If, on the contrary, a high way is chosen (fourth rib) it will be difficult to control the lower steps (mobilization of the gastroesophagus). From the left side these difficulties are overcome by the left bicostal thoracotomy. It is the only solution to execute both high and low steps of this intervention, both very distant from each other. We started using this technic in 1949 after having read a publication of Ochsner and De Bakey [1] in which they merely state: "We think it should

be recommended and we shall try it at the next opportunity."

If, instead, the right-sided thoracotomy is chosen, associated with laparotomy at one side and cervicotomy at the other, the entrance into the thorax should be made through the bed of the fifth rib. At that side bicostal thoracotomy is not necessary as only the esophagus has to be liberated. The abdominal steps of gastric liberation are done by laparotomy.

If the tumor is mid-thoracic, the anastomosis falls upon the highest segment of the thoracic esophagus and will be done by the thoracotomy itself (always bicostal at left and unicostal at right).

For a long time we have been using both entrances to operate upon tumors of the upper thoracic esophagus, and we originated the method of operation with two teams, thoracic and abdominal, working at the same time [2], thus reducing the time of the intervention to two hours and forty minutes in one case. Although such an economy of time must not be underestimated, we think that one well trained team can perform the operation, either from the right or left side, in about four hours without any aggravation of the postoperative course.

We have to state that the entrance from the right side is more advantageous in effecting more complete anticancer surgery, for the following reasons: (1) We fall upon the esophagus after ligation of the arch of the azygos vein and dissect the tumor, having the ganglionic component in sight; a careful examination of the ganglions of the carina is made. (2) Only one pleura, the right, is opened. (3) Hemorrhagic accidents in cases of tumors adherent to the azygos or the aortic arch, always possible if operating from the left, are avoided. (4) The aorta is not in front, hiding the end of the esophagus necessary for the anastomosis that will be possible at any point of the thoracic esophagus. (5) The difficult uncrossing of the aorta and esophagus with or without liberation of the aortic arch is not necessary, whereas it is indispensable when using the left side. Nevertheless, the left-sided entrance, with bicostal thoracotomy, is easier to execute, needs not so complicated a means, and may be effected by one surgeon only. The right-sided entrance of simultaneous action calls for the intervention of two trained surgeons.

As a conclusion we may say, so far, that if the x-ray reveals that the tumor is limited in size and if general conditions are very good (i.e., the tumor is easily resectable and there are few ganglionic metastases), the left-sided entrance by bicostal thoracotomy and mobilization of the aortic arch by previous ligation of the superior intercostals is sufficient for its complete ablation. If the tumor is of greater volume and strictly retroaortic, resection will only be performed as a palliative procedure and from the right side. The judgment of these facts depends upon the surgeon's experience, as it is sometimes impossible to guide oneself by the radioendoscopic report, the time of dysphagia or the patient's age, so that only thoracotomy will reveal exactly the pathologic characteristics of the injury. Besides, the tumor may not be very extensive but there may be metastasis in the group of coronary ganglions which we could observe in a high percentage (65 per cent of the operated cases) of the carcinomas of the upper retroinfra-aortic esophagus.

This fact, which of course alarmed us and dampened our former enthusiasm as to a final success with that location, exacts as a first measure, before resolving on radical operation, the exploration of the aforementioned group of ganglions such as we made recently by a small left-sided transrectal laparotomy. If there are any metastases, only the palliative operation remains. Exact technical details of that procedure are to be found in former studies of ours [3–5].

CANCER OF THE LOWER THORACIC ESOPHAGUS

When examining the x-rays of patients with neoplasms of the lower esophagus and cardias, including a very careful examination of the fundus gastricus in the different radiologic positions, we must be aware that it is impossible to state exactly, by the methods of preoperative examination so far at our disposal, the extent of tumor diffusion, especially at the wall of the stomach. Endoscopic biopsy may show the histologic structure of an adenocarcinoma and that entitles us to suppose that the tumor reaches a wider gastric extension, which would not be the case if it were of esophageal origin, the biopsy showing us a squamous epithelioma. As a matter of fact, that differentiation is of little value, and in our experience only exploratory thoracotomy allowed us to appreciate the extent of the injury.

We are not followers of the systematic practice of endoscopy, which we only indicate in selected cases; this has been explained in former studies [6].

The technic used for the resection of that type of carcinoma differs according to its location and extent. It is as perfectly established as that of a subtotal gastrectomy.

If the tumor is at the lower esophagus and cardias, limited to these sectors, resection will be followed by infra-aortic esophagogastrotomy after a left-sided universal thoracotomy through the bed of the seventh rib. Several years ago we ceased using, in these cases, the abdominothoracic incision as we consider it insufficient for the steps of the anastomosis.

If the so-located tumor extends upward upon the lower esophagus, beyond the lower pulmonary veins, the anastomosis can never be infra-aortic, and in those "limit cases" it must be supra-aortic. The technic will not differ from that used for resection of the upper thoracic esophagus.

If the tumor is located at the cardias, invading the stomach extensively so that it can be eliminated only by total gastrectomy, the anastomosis will be esophagojejunal, infra-aortic and intrathoracic. If one prefers to practice it with a jejunal loop, it will have to be completed with the wide enteroanastomosis of Braun, for discharge, at the bottom of the lifted loop. If the loop permits that operation, we prefer it because of its technical simplicity. If the bowel of the loop is very short so that it cannot be brought up to the resected esophagus, we follow the technic of Roux.

This operation is executed with the same left-sided thoracotomy through the bed of the seventh rib, although in every case the possibility of extending the thoracic incision to the abdomen should be studied, especially if any ypsiliform anastomosis should be necessary.

PALLIATIVE OPERATIONS

Evidently, as the team's experience grows, the number of patients undergoing resection will increase. However, in view of the extent reached by the lesion, certain cases may only be resolved by "ultra-resections." These involve a high operative death rate and, because of their doubtful results, we do not feel authorized to recommend them.

In 1948 we began performing derivative esophagofundic operations by way of the thorax in cases of very advanced neoplasms of the lower esophagus and cardias, without invasion of the gastric fundus, using a jejunal loop. If the loop was too short we applied ypsiliform anastomosis for that derivation. We extended that technic to a non-resectable carcinoma of the medial esophagus, obtaining a good palliative result. Through a left bicostal thoracotomy we made an esophagogastric supra-aortic side-to-side anastomosis. It is a technically difficult intervention, although not impossible [7–10].

These anastomoses can only be decided during the thoracotomic exploration and after being fully convinced that any attempt at resection would be useless. The patient's condition should be such that he could undergo resection if this were possible otherwise. This means that a small number of patients still remain who cannot even be put to these derivative interventions.

ANESTHESIA, AND PREVENTION AND TREATMENT OF SHOCK

The appraisement of the cardiovascular state of these patients is not different from that of any other surgical patient [5]. As these are risky operations, they can only be practiced, especially in case of high located injuries, on patients of good cardiocirculatory capacity, belonging to groups I and II of the classification of the New York Heart Association. Exceptionally, those belonging to group III could be enclosed into group II after adequate treatment.

Anesthesia. We recommend a general anesthesia with flebonovocain and small doses of pentothal®-flaxedil® [11]. It is possible to maintain an infusion of 30 mg. per minute without surpassing 3 or 4 gm. of the drug during an interval of three hours. The patient wakes up quickly, without vomiting, is lucid enough to obey orders and has all his capacity for coughing to throw out the bronchial mucous plugs.

Preoperative Preparation. Treatment of chronic shock consists of adequate soft hypercaloric nutrition with an adequate number of total blood transfusions, trying to resolve the complex problem of the electrolytic equilibrium. We think that not more than seven to ten days should be spent with the preoperative preparation. We have the patient do respiratory exercises and have sessions of oxygen therapy. Two days before the date of the inter-

vention we start the parenteral supply of antibiotics. At the same time 1 gm. of streptomycin dissolved in 5 cc. of serum is given per os.

Hemotherapy and Drugs. It is well known that the transfusion during the operation is not enough to avoid the surgical shock in these great interventions. Not only the reduced blood volume must be made up for by supply of total blood, but also the powerful depressing stimulus and the neuroendocrin exhaustion causing loss of vasomotor tonus which render insufficient any intent of compensation. Noradrenaline and ACTH are the almost "specific" drugs that, together with blood, make these interventions possible.

Postoperative Therapy. In the postoperative state it is important to maintain the systematic tension between 8 and 10 maximum with levophed® and ACTH, if necessary until stabilization. In spite of his apparent quietness, the patient must not be left with a maximum tension of 6 or less, for the possibility of renal damage is great. Once the intervention is finished, the patient has to stay in the recovery room until he is re-animated and lucid, obeying orders, with his maximum systematic tension over 100. He will be brought out once the accumulated secretions have been aspirated through the tube of tracheal intubation. Serious cardiovascular accidents, including cardiac arrest, may follow if these patients are moved too soon or rudely handled when moved from the operating table to the stretcher and from there to bed, if there are not hands enough to take charge of these movements.

We always drain the thorax, taking care that the aspiration under water begins while the patient is still in the operating room. This allows control of the hermetic closure of the thorax, the residual pleural air bubbling out when the anesthetist makes a hyperpression. We maintain this slight aspiratory drainage for three or four days, although little is aspirated after the first forty-eight hours. Maintaining it may be useful in case of possible complications, e.g., effusion, atelectasis and early filtrations of the anastomosis.

With the common esophagogastric or esophagojejunal anastomosis, we do not use the nasopharyngeal sound, but recommend it if the intervention involves cervical esophagogastric or subpharyngogastric anastomosis. It is the only way to feed the patient without difficulties during the first days and without the functional disturbances of deglutition causing tracheobronchial inundation by the food.

In patients with a past history of bronchial disturbance and bronchorrhea, we take the risk of making a tracheotomy while still in the operating room, once the esophagectomy is finished. That provisional tracheotomy may be decisive if very frequent aspirations of the bronchial tree should be necessary immediately after the operation.

SUMMARY

We have divided our surgical experience into two periods. During the first period, when surgery of the esophagus was still in the development stage, results were little encouraging, but it helped to work out the present technics.

From 1948 until August, 1955, 164 patients were observed. Fifty-four (32.9 per cent) were not operated upon; 110 (67 per cent) were explored; of these, 101 (91.8 per cent) underwent resection. This high percentage of resections shows that there was not any selection of favorable cases, so that many were rather advanced, but there was hope of doing them good by palliative operations.

The resections of infra-aortic cancers brought about a death rate of 17.6 per cent (on fifty-one resected); the death rate of supra-aortics was 62.7 per cent (forty-three cases); of the cervicothoracics, three of five cases died (60 per cent). We think that these figures should be referred to the hospital medium in which we have been working.

The final results will be the object of a further study, and we merely state that there are three patients surviving five years, eight surviving between five and three years, and a not exactly stated number surviving less than two years which, however, being so recent are not yet interesting.

In our general hospitals it is very difficult to follow up the patients, because so many arrive indiscriminately from faraway places of this large country with whom contact is lost afterward.

Of 226 cancers of the esophagus, three cervical cases were observed. In one the operation of Wookey was practiced with good functional result, but the patient died from metastasis just when the plastic procedure was finished. That type of operation is confined to aged patients or those on whom, because of their general condition, a cervical subpharyngogastric anastomosis cannot be done.

With carcinoma of the upper thoracic esophagus, two locations are considered: the thoracocervical supra-aortic and the retroinfra-aortic (mid-thoracic) carcinoma. In the first case resection will be followed by cervical esophagogastric anastomosis; in the second case esophagogastric anastomosis is done intrathoracically and supra-aortically.

After having tried different ways of entrance, at present we proceed as follows. If the radiograph reveals that the tumor is little extended, if there are few metastasic adenopathies and the patient is in a good general condition, left-sided bicostal thoracotomy is practiced, with mobilization of the aortic arch by previous ligation of the upper intercostals. If the tumor is extended and prevailingly retroaortic (mid-thoracic), it is attacked by right-sided thoracotomy together with left-sided laparotomy (after Lewis). In these cases the resection is considered as palliative only. In 65 per cent of these operated patients ganglionic metastases have been found at the abdominal coronary group (left gastric artery).

In cases of non-extended carcinomas of the lower esophagus and cardiac orifice of the stomach, end-to-side esophagogastrostomy following the technic of Sweet is done at the fore or hind gastric surface correspondingly, by low left-sided thoracotomy.

End-to-end tubular esophagogastric anastomosis is effected only by exception.

When the tumor enters the lower esophagus, reaching a point above the level of the lower pulmonary veins, supra-aortic esophagogastric anastomosis is practiced.

If the tumor of the cardias extends into the stomach, total gastrectomy with esophagectomy is made, followed by infra-aortic intrathoracic esophagojejunal anastomosis. Only exceptionally ypsiliform anastomosis (Roux or Rienhof) is applied.

We are not given to palliative ultraresections in advanced cases because of the high death rate and bad further results. Since 1948 these patients have been treated by esophagofundic side-to-side derivative anastomosis.

If the top of the stomach is invaded, the circuit is established with a jejunal loop.

Only once could we practice this type of anastomosis on a mid-thoracic carcinoma with a good result (patient surviving fifteen months).

A new type of intervention for the non-resectable cases is being developed.

Through a simple gastrostomy without thoracotomy a tube could be placed through the tumor, thus re-establishing the passage of the esophagus and allowing radiotherapy to be practiced.

As general anesthesia the authors recommend flebonovocaine complemented with small doses of pentothal-curare.

The operated hemithorax is drained, keeping a slight aspiration during three to four days. In common resections no nasopharyngeal sound is used, this being applied only with subpharyngo or esophagogastric cervical anastomosis in order to avoid the laryngeal reflux.

Once the esophagectomy is finished, a temporary tracheotomy is recommended for any patient with a past history of bronchial disturbance and bronchorrhea.

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Primary Esophagogastrectomy for Instrumental Perforation of the Esophagus

WITH A REPORT OF TWO CASES

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INSTRUMENTAL perforation of the esophagus incident to diagnostic and therapeutic procedures is a risk accepted by endoscopists. Such technical errors are usually, at least in part, attributable to one or more characteristics of the esophagus which seem to render it more vulnerable to perforation than other organs subjected to endoscopy. The esophagus is normally a comparatively friable structure, following closely the course of the lower cervical and thoracic spine. Its posterior location, coupled with its fairly taut position between points of fixation at the upper and lower ends, does not permit appreciable mobility of the organ during endoscopy. Moreover, the natural friability of the esophagus is usually increased by the diseases to which it is subject. Finally, most esophageal diseases requiring esophagoscopy produce some degree of obstruction, and attempts to overcome this obstruction often result in perforation. The two cases reported herein represent examples of this unfortunate accident.

CASE REPORTS

CASE 1. C. D., a forty-four year old unmarried white woman, was first seen at the Ochsner Clinic on December 28, 1945, complaining of difficulty in swallowing, regurgitation and a sense of fullness after eating, of twenty years' duration. She apparently had experienced little real difficulty until three months prior to admission, when she began to have increasing dysphagia and regurgitation of undigested food in amounts of about 1 cupful per episode to the extent of about 3 quarts a day. During these three months she had lost about 30 pounds. Esophageal dilation performed one week previously had produced some beneficial effect for two or three days.

Physical examination on admission revealed an emaciated, dehydrated, chronically ill woman who weighed 100 pounds. Roentgenographic examination of the esophagus following ingestion of barium showed moderate dilatation above the level of the diaphragm, at which point a smooth, conical constriction was observed. Esophagoscopy performed with use of a general anesthetic disclosed a greatly dilated esophagus containing about 500 cc. of retained fluid and food particles. At the level of 45 cm. from the upper incisor teeth an area of chronic irritation and constriction was encountered. There was no suggestion of tumor and the area of constriction was dilated with a No. 32 F. bougie.

The diagnosis was thought to be achalasia. The patient was discharged from the hospital on January 5, 1946, with instructions to use the Hurst bougie three times daily for three weeks, after which dilation could be performed as indicated by the symptoms.

The patient was seen in the Clinic at approximately six-week intervals. In spite of fairly good clinical response to dilation, roentgenography of the esophagus indicated persistence of a considerable degree of obstruction at the cardia with dilatation and redundancy of the esophagus above. Esophagoscopy on November 19th confirmed the persistence of the area of constriction at the cardia. Operative correction of the chronic obstruction was deemed advisable. Accordingly, on November 25th, esophagogastrostomy of the Heyrovsky type was performed by exposure through the bed of the eighth rib on the left side. The postoperative

FIG. 1A. Case 1. Roentgenogram showing severe stricture at the site of esophagogastrostomy of the Heyrovsky type performed seven years previously.

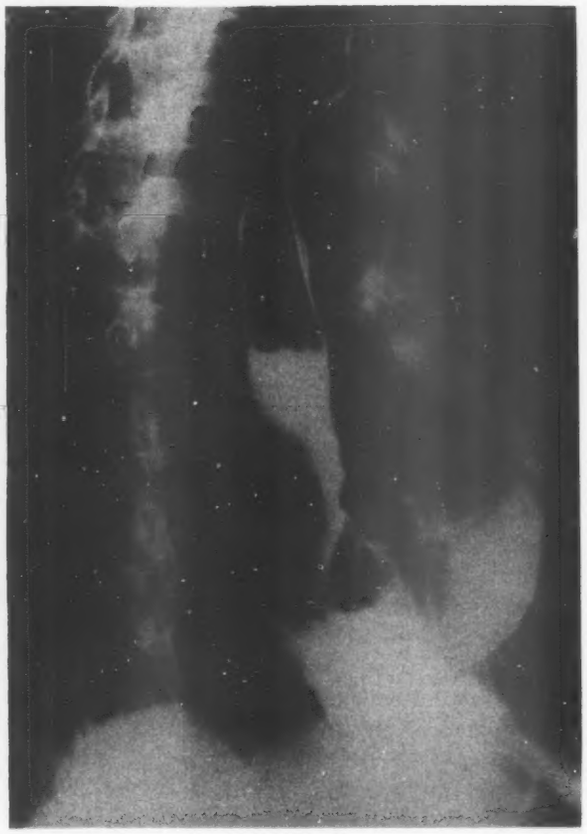

FIG. 1B. Case 1. Postoperative roentgenogram of the upper gastrointestinal tract showing an adequate stoma.

clinical response was most gratifying. Roentgenography indicated an adequate stoma, and persistence of esophageal dilatation, which was evident at three months postoperatively, had become of minor degree by the fifth month following operation.

The patient was not seen again until May 5, 1954, when she returned to the Clinic because of recurrence of dysphagia and regurgitation of about one month's duration. Roentgenography of the esophagus following ingestion of barium revealed that the stoma, which was 5 cm. above the diaphragm, measured about 4 mm. in diameter and the esophagus above this constriction was dilated to a diameter of 4.5 cm. (Fig. 1A.)

On May 6th, with use of a general anesthetic, the site of stricture was visualized esophagoscopically and satisfactory dilation was accomplished by use of a No. 30 silk bougie dilator. In the early evening, following recovery from the anesthetic and after having taken fluid for the first time, the patient complained bitterly of pain in the region of the chest and upper portion of the abdomen. Examination revealed splinting of the thorax and board-like abdominal rigidity. There was no evidence of subcutaneous emphysema of the thoracic, abdominal or cervical regions. Plain roentgenograms of the chest and the region of the diaphragm revealed no evidence of pneumothorax, mediastinal emphysema, subdiaphragmatic collection of air or of a fluid level. Because an esophageal perforation was definitely believed to be present, examination with lipiodol was not done.

Thoracotomy was performed fifteen hours following esophagoscopy; the chest was entered through the bed of the eighth rib on the left side. The pleural space was largely obliterated in its lower half by filmy, avascular adhesions incident to the previous operation. As the left paravertebral gutter was exposed when these adhesions were divided, a considerable amount of edema was encountered. In the immediate vicinity of the lower portion of the esophagus

turbid fluid containing flecks of fibrin were in evidence, and a slit-like opening in the left side of the esophagus was identified about 5 cm. above the diaphragm. The perforation was in an area of stricture and dense periesophageal scarring without evidence of tumefaction. The diaphragm was opened. The lower portion of the esophagus and the upper portion of the stomach were mobilized in their entire circumference. Segmental resection of these organs above and below the site of stricture and perforation was performed with preservation of a large branch of the left vagus nerve. The cut edge of the stomach was closed, after which anastomosis between the esophagus and anterior wall of the stomach was performed, two layers of cotton sutures being used. The hiatus was reconstructed about the gastric pouch and a Levin tube was passed into the stomach by the anesthetist. Anterior and posterior thoracotomy tubes were inserted and the thoracic wall was closed. Examination of the excised specimen by the pathologist confirmed the presence of stricture, and the tract extending through the muscular coat was identified. The postoperative course was complicated only by the necessity for thoracentesis of 90 cc. of fluid after the thoracotomy tubes had been removed.

The patient has been examined periodically since operation, the last time being more than two years postoperatively, at which time no clinical or roentgenologic evidence of recurrence of esophageal dysfunction could be found. (Fig. 1B.)

CASE II. M. A. D., a seventy year old white man, was first seen at the Ochsner Clinic on February 8, 1956, complaining of inability to eat. Eight months previously he had noted difficulty in swallowing, first solid foods and later liquids. Roentgenographic examination of the upper gastrointestinal tract and esophagoscopy had been reported to show cardiospasm. Various oral medications were taken for the ensuing three months, during which time he had only slight dysphagia and infrequent vomiting. These symptoms became worse in October, 1955, and roentgenographic study of the upper gastrointestinal tract and esophagoscopy again indicated cardiospasm. Symptoms had become progressively worse, so that for almost two months before admission the patient had been unable to take any solid food and for one month had taken liquids only with difficulty. He had lost 35 pounds during the preceding three months. He would have five to seven attacks of vomiting in twenty-four hours. The vomitus appeared to be undigested food with no apparent bile content and was not unduly foul. He had had no pain associated with this illness.

Physical examination on admission revealed a chronically ill man showing evidence of recent loss of weight, slight dehydration and the presence of a small left inguinal hernia. The blood pressure was 125 mm. Hg systolic and 65 mm. Hg diastolic, and the pulse rate was 72 beats per minute.

An esophagram showed mild dilatation of the esophagus with retention of fluid. Gradual tapering of the lower end of the esophagus, extending over a length of 3 to 4 cm., was noted. At no time could this narrowed segment of the esophagus be distended, and passage of barium into the stomach was delayed. These observations were believed to be consistent with a diagnosis of achalasia. (Fig. 2A.)

On February 10th, esophagoscopy, performed with use of a topical anesthetic, showed dilatation of the esophagus and, at the level of 45 cm., narrowing to complete constriction without evidence of inflammation or tumor. Biopsy from the area of constriction, which contained mucosa, submucosa and smooth muscle, was performed and essentially normal esophagus was reported.

Attempts to have the patient swallow a string for the next two days were unsuccessful. Accordingly, on the morning of February 13th dilation of the cardioesophageal region under fluoroscopic guidance was performed by use of the Mosher bag. During the procedure the patient complained of severe pain, which persisted thereafter. The blood pressure was 100 mm. Hg systolic and 60 mm. Hg diastolic, pulse rate 100 per minute and respiratory rate 26 per minute. The patient was in obvious pain with splinting respiration, epigastric tenderness and muscle guarding which bordered on board-like rigidity. No abnormality was detected on auscultation of the chest and the abdomen was silent.

Roentgenography of the chest showed only slight accentuation of the pulmonary markings at the bases. No infiltration, no air in the pleural space or below the diaphragm and no evidence of disease of the heart or mediastinum were demonstrated. Roentgenography of the

FIG. 2A. Case 11. Esophagram which was interpreted as consistent with a diagnosis of achalasia.

FIG. 2B. Case 11. Roentgenogram five months postoperatively showing satisfactory result of esophagogastrectomy.

abdomen revealed no abnormality. It was thought that perforation of the esophagus had occurred and the patient was prepared for operation.

Left thoracotomy was performed eight hours after esophageal dilation, access to the left pleural space having been afforded by a posterior lateral curvilinear incision with subperiosteal excision of the ninth rib and division of the eighth rib in the paravertebral line. When the pleural cavity was entered, a moderate amount of turbid fluid and fibrin was encountered; inspection of the lower esophageal region revealed considerable reaction in the mediastinal tissues and a laceration measuring about 4 cm. on the left side of the esophagus immediately above the hiatus. A radial incision was made through the central tendon of the diaphragm. Palpation of the cardioesophageal region revealed a tumor measuring about 5 cm. in diameter. The lesion was established as carcinoma by frozen section, and esophagogastrectomy was performed. All enlarged lymph nodes about the left gastric artery were removed by ligation of the artery close to the celiac artery, and the stomach was divided obliquely so as to construct a tube from the remnant of the greater curvature. The esophagus was freed up to the level of the lower portion of the pulmonary hilum and was transected well above the upper extent of the laceration. Esophagogastrostomy was performed by the two-layer technic with interrupted quilting cotton sutures. The diaphragm was repaired with reconstruction of the hiatus, and the gastric pouch was fixed to the mediastinal pleura to avoid tension on the anastomosis. The chest was closed with drainage by anterior and posterior thoracotomy tubes.

The pathologist reported the tumor to be a poorly differentiated epidermoid carcinoma. The proximal and distal ends of the specimen appeared to be free of involvement but there was metastatic involvement in two of ten lymph nodes identified about the left gastric artery.

From the sixth to the eleventh postoperative days the patient was troubled with diarrhea, which was attributed to vagotomy and sub-

sided with symptomatic therapy only. On the fourteenth postoperative day roentgenographic study of the upper gastrointestinal tract revealed satisfactory results and the patient was discharged from the hospital.

The patient was seen in the Clinic at three- and six-month intervals, and when last seen on July 13, 1956, was in satisfactory condition without clinical or roentgenographic evidence of recurrence of the tumor. (Fig. 2B.) The stoma is satisfactory, and the slight delay in emptying of the gastric pouch without evidence of obstruction, attributed to vagotomy, is of little consequence. The patient has gained weight, tolerates a normal diet and has returned to active farming.

COMMENTS

Although the cause of the esophageal disease in these two cases was entirely different, results of the clinical and radiologic studies were remarkably similar. Esophageal perforation occurred during an attempt to administer the simplest method of therapy for the ailment from which the patient was believed to be suffering. In each case the diagnosis was made on clinical grounds, there being no radiologic evidence of a perforated viscus. Positive radiologic proof of perforation could have been obtained by use of lipiodol if the diagnosis had been in doubt.

Early operation is imperative in patients with extensive esophageal laceration and gross contamination of the mediastinum and pleura. Expectant therapy (withholding oral intake and systemic use of antibiotics) is justified in patients with questionable or small perforations. The decision to perform a definitive procedure in these two cases was influenced largely by the nature of the process that precipitated the perforation, that is, almost total esophageal obstruction immediately distal to the perforation. Simple closure of the opening in the first case through dense scar tissue and in the second case just above the carcinoma would have left the patient still with the need for resection and would probably have resulted in development of an esophageal fistula. The mediastinum and pleura had been contaminated for fifteen and eight hours, respectively, but there had been no gross necrosis. By division of the esophagus and stomach well above and below the site of leakage it was possible to have healthy, well vascularized tissue for use in the anastomosis.

SUMMARY

The esophagus possesses anatomic characteristics which render it more prone to perforation than other organs. Two cases of instrumental perforation of the lower portion of the esophagus, successfully treated by primary esophagogastrectomy, are reported. In each case the diagnosis was made on clinical grounds with absence of confirmatory roentgenographic evidence. There was a preponderance of abdominal clinical manifestations, although in neither case was gross soiling demonstrated beneath the diaphragm at exploration. In these two relatively good risk patients who had low esophageal lesions for which resection would ultimately have been necessary, primary resection for instrumental perforation has produced satisfactory results.

Surgical Wound Infections

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ALTHOUGH antibiotics have eliminated many serious diseases, they have not solved the problem of postoperative wound infections. Instead they have inspired a false confidence leading to a lack of appreciation for basic aseptic surgical principles. Now that penicillin-resistant organisms are on the increase, the wound infection rate is on the rise. This is exemplified by the Third Surgical Service statistics where the rate during the years 1953 to 1956 steadily rose from 4.1 to 7.3 per cent. (Table I.) This increase in the rate of wound infection has lead to a study of certain sources of such infections.

TABLE I
ANNUAL INFECTION RATE

Year	No. of Operative Procedures	Wound Infections	Infection Rate (%)
1953	1,503	61	4.1
1954	1,511	71	4.7
1955	1,952	115	5.8
1956 (first 10 mo.)	1,552	114	7.3

RELATION OF WOUND INFECTION TO ADMISSION RATE

A monthly study of the rate of wound infection during the year 1955 was made to determine if it was effected by the total number of monthly admissions, the number of "dirty" cases admitted per month or the total number of monthly operative procedures. One would assume that the activity of the operating room and surgical ward would effect the chances of contamination. However, in this study, these factors were not significant. (Table II.)

TABLE II
MONTHLY INFECTION RATE

Month (1955)	Total No. of Admissions	No. of "Dirty" Cases Admitted	Total No. of Operations	Infections (%)
Jan.	245	35	144	6
Feb.	234	35	141	5
Mar.	255	37	180	2.8
Apr.	219	32	164	3.8
May	340	33	177	9
June	178	33	188	5
July	176	27	146	8
Aug.	191	26	156	10
Sept.	232	41	178	3
Oct.	231	44	164	8
Nov.	220	24	161	6.3
Dec.	169	31	142	10

CARRIER RATE

The majority of wound infections at the Boston City Hospital are due to hemolytic Staphylococcus aureus. Cultures of the nose and hands of fifty-two non-hospitalized patients treated on the Accident Floor of the Boston City Hospital were studied for the presence of this organism. Cultures were taken with dry sterile swabs and sent immediately to the Bacteriology Laboratory. Eighteen (34.6 per cent) of the patients were nasal carriers of hemolytic Staph. aureus; six (11.5 per cent) were skin carriers; two (3.8 per cent) were both nasal and skin carriers. The carrier rate falls within the limits reported by other workers. (Table III.)

Skin cultures were taken in the operating room from proposed sites of incisions in fifty-seven hospitalized patients. Six (10.5 per cent) were skin carriers of hemolytic Staph. aureus, which did not differ significantly from the rate found among non-hospitalized patients. It be-

comes clearly obvious that a great many of our patients were contaminated when they entered the hospital.

For comparison, the hands and noses of twelve house officers of our service were cultured. Seven (58.3 per cent) were nasal carriers;

TABLE III
CARRIER RATE FROM LITERATURE AND PRESENT STUDY

Source	No. of Cases	Nose (%)	Skin (%)	Nose and Skin (%)
Hallman [1]	158	39	0	0
McFarlan [2]	132	35	0	0
Devenish and Miles [3]	40	45	5	2.5
Gillespie et al. [4]	159	43	20	13.0
Vierthaler [5]	100	0	21	0
Smith [6]	100	32	5	4.0
Martin [7]	100	0	24	0
Howe [8]	479	47.4	18.4	11.7
Present series	52	34.6	11.5	3.8

one (8.3 per cent) was a skin carrier and one (8.3 per cent) was both a nasal and skin carrier.

These brief studies emphasize that hospital personnel are carriers of staphlococcus, and they should protect wounds from contamination by wearing masks and using either instrument or sterile glove technic in all dressing changes. Since we have shown that a high percentage of our patients are contaminated on entry to the hospital, the latter procedures also will protect the hands of the surgeon from the patient's bacterial flora.

WARD CONTAMINATION

The Third Surgical Service consists of three well ventilated, clean, open, thirty-two–bed wards. Six blood agar plates were exposed on each ward, three for one hour and three for two hours, and bacterial counts were performed after incubation. Hemolytic Staph. aureus was cultured from each ward demonstrating the dangers of exposure of clean surgical wounds to the air from such wards. Since the air becomes more contaminated by the raising of dust from mopping and sweeping of the wards, all dressings should be done prior to these procedures.

Cultures taken from the linen did not grow hemolytic Staph. aureus whereas cultures from the blankets did. This may be due to the fact that linen is changed daily or as soon as it is soiled whereas blankets are changed more infrequently. Therefore, these blankets should not be allowed in the operating room and all patients transferred to the operating room should have clean linen and blankets.

Cultures were taken from four dressing carts that were previously cleaned with 70 per cent alcohol solution and from two carts not cleaned. Cultures from the dirty dressing carts produced hemolytic Staph. aureus whereas those cleaned did not. The danger in using dirty dressing carts for changes of dressing is obvious, so that all carts should be thoroughly cleansed with 70 per cent alcohol solution before or after they have been used. These carts should be used by well instructed professional personnel only.

OPERATING ROOM CONTAMINATION

Ten operating rooms used by various surgical services at the Boston City Hospital were studied by exposing one pair of blood agar plates for one hour and another for two. Half the rooms were contaminated with Staph. aureus. Such bacteria no doubt were introduced into the operating rooms by patients and professional personnel either because they were nasal carriers or their skin, clothes, blankets and linen were contaminated. Operating suites must be kept as free as possible from the main stream of traffic and only patients and personnel suitably dressed and masked should have access to the operating room suite.

VALUE OF PREOPERATIVE PREPARATION OF SKIN

Skin cultures were taken from fifty-seven proposed operative sites before and after preparation with two soap scrubs with G-11 followed by ether, 70 per cent alcohol and tincture of zephiran.® Skin cultures also were taken from the wound before applying the skin sutures and on first changing the dressing. (Table IV.) It was apparent that the preoperative preparation of the skin was relatively effective in clearing the surface organisms from the wound. After preparation of the skin, 80.7 per cent had negative skin cultures. Nevertheless, preoperative preparation does not completely sterilize the skin, and the resident bacteria in the skin appendages rise to the surface during operation and further contaminate the wound. However, as can be seen from our series, there was still a great reduction in bacterial flora just before closure of the wound as compared to before the

preparation of the skin. These results contradict the findings of Lowell [9] who cultured more organisms from wounds before closure than before preoperative preparation of the skin.

These facts emphasize that the skin should be protected as much as possible during the course of the operation by the proper use of skin towels, preferably those in which there is an inner layer of plastic or some other impermeable material. A dry operative field is essential to prevent the drapes from becoming wet, and there may be some value in the double set-up in all operations. This refers to the setting up of a separate tray to contain all the instruments needed up to the point where the deep knife is required, and includes wearing a double set of gloves. The superficial gloves and the tray with all the instruments are discarded after the skin towels are fixed.

TABLE IV
VALUE OF PREPARATION OF SKIN IN REDUCING BACTERIAL FLORA FROM OPERATIVE SITE

Organism Cultured	Colony Count			
	Before Preparation of Skin	After Preparation of Skin	Before Wound Closure	First Postoperative Dressing
Hemolytic Staph. aureus	8	1	1	13
Non-hemolytic Staph. aureus	14	2	1	11
Staph. albus	36	3	15	16
Staph. citreus	4	0	0	0
Bacillus coli	4	0	1	5
B. subtilis	29	6	1	9
Diphtheroids	31	1	2	12

VALUE OF MASKS

Three house officers talked and breathed for five minutes into blood agar plates held at a distance of 18 inches from their faces without any mask and when wearing a single or double mask. (Table v.) Although numerous organisms were cultured for the convenience of tabulation, only the total colony counts were used. One of the doctors was a nasal carrier of hemolytic Staph. aureus, and he transmitted the organism through a double set of masks into a blood agar plate. There appeared to be no advantage to wearing two masks over one nor was one mask much of an improvement over none.

Since these house officers were talking during the testing, it was decided to observe what effect the absence of talking would have on the colony counts. Nine medical students were studied with blood agar plates held 18 inches from their faces with and without a mask and with and without talking. (Table vi.) When the students talked, the masks cut the colony counts in half, but they were still higher than the counts obtained by not talking even without a mask. When silence was the rule, the lowest counts were obtained and masking did not improve the situation.

TABLE V
COLONY COUNT ON BLOOD AGAR PLATES HELD 18 INCHES FROM FACE

Surgeon	No Mask	One Mask	Two Masks
A	15	4	3
B	11	12	8
C	7	3	5

TABLE VI
COLONY COUNT ON BLOOD AGAR PLATES HELD 18 INCHES FROM FACE

Student	No Mask, No Talking	No Mask, Talking	One Mask, No Talking	One Mask, Talking
A	3	11	2	2
B	6	20	1	7
C	5	14	3	5
D	2	5	5	4
E	0	2	1	3
F	1	11	0	1
G	0	8	1	3
H	0	10	2	5
I	4	6	6	8
Total	21	87	21	38

SUMMARY

1. The increase in wound infection on a surgical service led to a study of possible sources.

2. The infection rate has no relation to monthly admission rate, number of "dirty" cases admitted or number of operative procedures.

3. Staph. aureus was present on the skin or in the noses of 49 per cent of patients and 74 per cent of the house staff.

4. Blankets are a major source of contamination on the wards.

5. The air of wards and operating rooms is laden with offending bacteria.

6. Preoperative preparation of the skin lowers the bacterial flora but does not eliminate it.

7. Silence is more valuable than masking.

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Erythromycin and Erythromycin-Neomycin for Intestinal Antisepsis

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ERYTHROMYCIN and erythromycin combined with neomycin have been evaluated as part of a program investigating various antibacterial agents for the preoperative preparation of the colon [2–8]. Preoperative conditions were simulated by combining antibiotic administration with mechanical cleansing.

METHODS

Patients in good condition without known colonic lesions were selected at random from the Louisiana State University Surgical Service of the Charity Hospital of Louisiana at New Orleans. No other antibacterial agents were administered during the study period and the patients were not subjected to surgery during the period of investigation.

After a control stool was obtained the patients were given a low residue diet and a laxative. Daily enemas completed the routine for mechanical preparation of the colon.

Bacteriologic analyses were conducted on stools each day during therapy and for one or two days after therapy. Drug sensitivity of each organism recovered in the stool each day was evaluated.

Bacteriologic technics were identical with those used in previous studies [4,7]. A weighed quantity of stool was serially diluted with sterile water and each dilution plated aerobically and anaerobically so that a total of fifteen plates was made initially from each stool specimen.

At appropriate intervals the plates were counted and organisms identified through Gram stain smears and subcultures. Additional subcultures and tests, such as the heat and catalase tests, were performed when necessary. Organisms were identified by the same technics used in previous studies [4,5,7].

Disks containing various concentrations of the drugs were used for sensitivity studies.

ERYTHROMYCIN

Erythromycin was administered, 500 mg. every six hours for seventy-two hours. Five patients were studied. (Fig. 1.)

Streptococci were present in four control specimens and appeared on the first day of therapy in the fifth patient. Streptococci were present in undiminished concentration in three patients at the end of therapy but were not found in the other two. In one of these they appeared prominently on the first day after therapy but no specimens were available after therapy in the other.

Staphylococci were present in only two control specimens but appeared after two days of therapy in two additional patients. By the end of therapy, staphylococci were present in undiminished concentration in three patients and were absent from the remaining two patients.

Coliform organisms were present in all control specimens and were not removed from any of the patients by the end of therapy. Their concentration was slightly diminished in three patients but even in these three the concentration was so high at the end of therapy as to indicate insignificant drug activity.

Clostridia were present in three control specimens and appeared transiently on the second day in a fourth patient. Clostridia were not present at the end of therapy in any patients.

Bacteroides were present in all control specimens and had been removed from four patients by the end of the second day of therapy. Bacteroides were present in four patients at the end of therapy and continued to be present immediately after therapy.

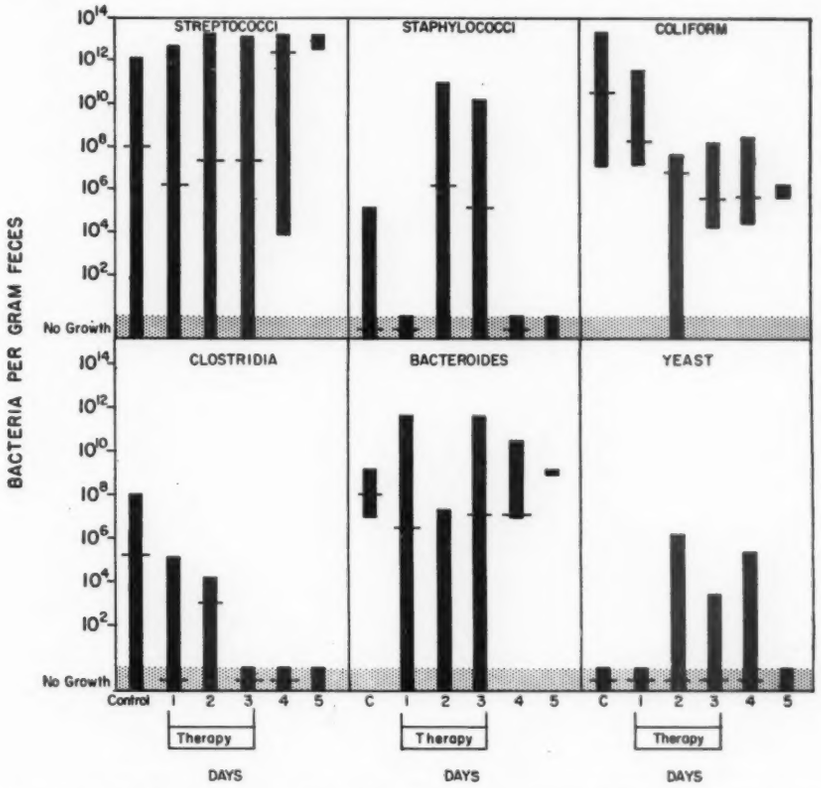

FIG. 1. Effect of erythromycin given for three days on bacteria in feces. Bars indicate maximum and minimum values each day. Cross marks indicate median value.

Yeasts were not present in any control specimens. They were found in only one patient on the last two days of therapy and the first day after therapy.

In addition to these organisms, proteus and pseudomonas species were each found in three patients and lactobacillus was found in one patient.

Sensitivity studies were conducted using disks containing 5 and 50 μg. of erythromycin. (Table 1.)

All streptococci found in the control speci-

TABLE 1

ERYTHROMYCIN: SENSITIVITY TO 5 AND 50 μG. OF DRUG BEFORE AND AFTER THERAPY

Patient	Streptococci		Staphylococci		Coliforms		Clostridia		Bacteroides	
	Before	After	Before	After	Before	After	Before	After	Before	After
Ale	S^{5}*	NS†	NG‡	NS	S^{50}*	NS	NG	NS	S^{5}	NS
Bou	S^{5}	R§	NG	NG	S^{50}	R	S^{50}	NG	S^{5}	R
Mil	S^{5}	R	NG	NG	S^{50}	R	S^{5}	NG	S^{5}	R
Var	NG	S^{5}	S^{5}	NG	S^{50}	S^{50}	S^{5}	NG	¶	R
Wal	S^{5}	S^{5}	S^{5}	NG	S^{50}	S^{50}	NG	NG	S^{5}	R

* $S^{(5-50)}$: Sensitive to 5 or 50 μg. of drug.
† NS: No specimen.
‡ NG: No growth.
§ R: Resistant to drug activity.
¶ Sensitivity studies not conducted.

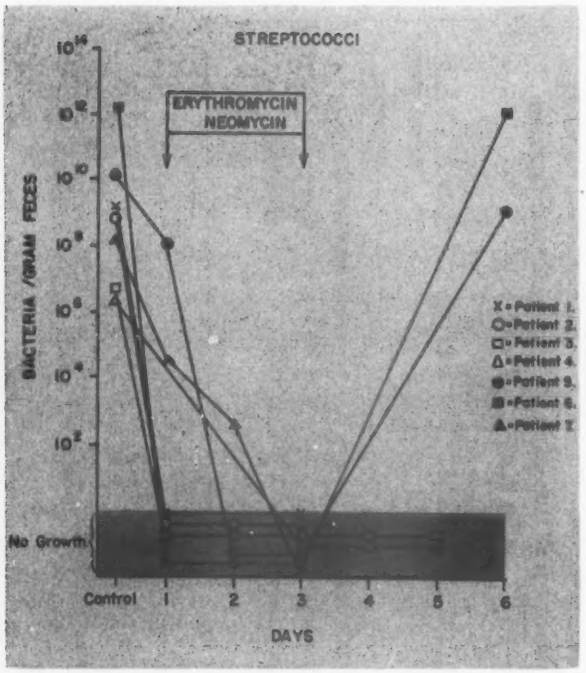

FIG. 2. Streptococci per gram of stool in patients on erythromycin-neomycin for three days. Each symbol represents an individual patient. Symbols are plotted only for days when specimens were actually analyzed. Symbols in area of "No Growth" indicate specimens studied and found not to contain these organisms.

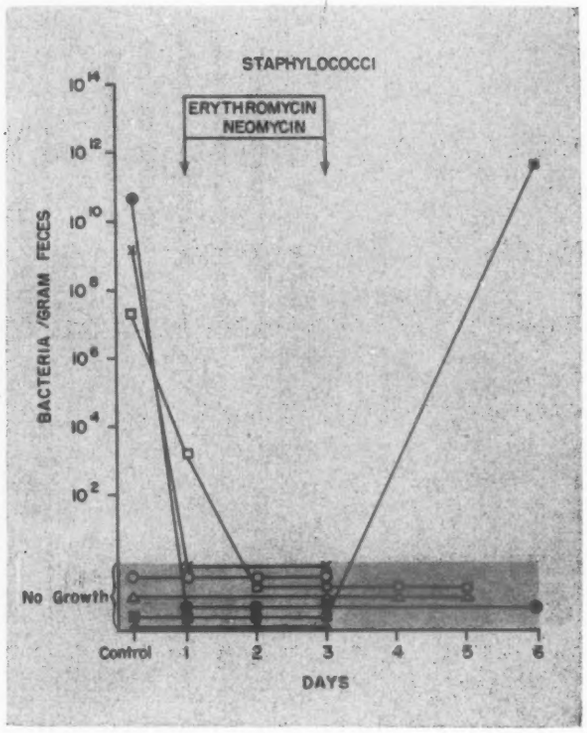

FIG. 3. Staphylococci in feces during and after erythromycin-neomycin therapy.

mens were sensitive to 5 μg. of erythromycin. In one patient streptococci became resistant to 50 μg. of erythromycin at the end of the second day and in another patient they became resistant at the end of the third day. In one patient who maintained streptococci throughout therapy and in another patient in whom streptococci disappeared during therapy and then reappeared, sensitivity to 5 μg. of erythromycin remains unchanged.

Staphylococci in two control specimens were each sensitive to 5 μg. of erythromycin. Staphylococci subsequently appeared in two other patients. In one of these, staphylococci were sensitive to 5 μg. In the other, one strain continued to be sensitive to 5 μg. of erythromycin while another strain which was sensitive to 50 μg. of erythromycin became resistant to the drug.

All coliforms found in the control specimens were sensitive to 50 μg. of erythromycin. One patient became resistant on the first day of therapy but subsequently had both resistant and sensitive strains. Coliforms in another patient became resistant on the second day of therapy and remained resistant. Sensitivity for the other patients remained unchanged during and after therapy.

Clostridia were sensitive to 5 μg. of erythromycin in two control specimens and sensitivity was unchanged during therapy. The third patient, whose organisms were sensitive to 50 μg. of erythromycin in the control specimen, did not again demonstrate these organisms. Since clostridia were not found after therapy, it is not possible to evaluate any change in sensitivity.

Bacteroides in the control specimens were all sensitive to 5 μg. of erythromycin. Bacteroides were resistant to erythromycin at the end of the first day in one patient, at the end of therapy in another patient and during therapy in a third patient.

Comments. The inadequate control of streptococci, staphylococci, coliform organisms and bacteroides make this an unsatisfactory drug for preoperative preparation of the colon.

ERYTHROMYCIN-NEOMYCIN

Erythromycin-neomycin was administered according to this schedule: 250 mg. of erythromycin and 1 gm. of neomycin, given in combination every hour for four hours, then every six

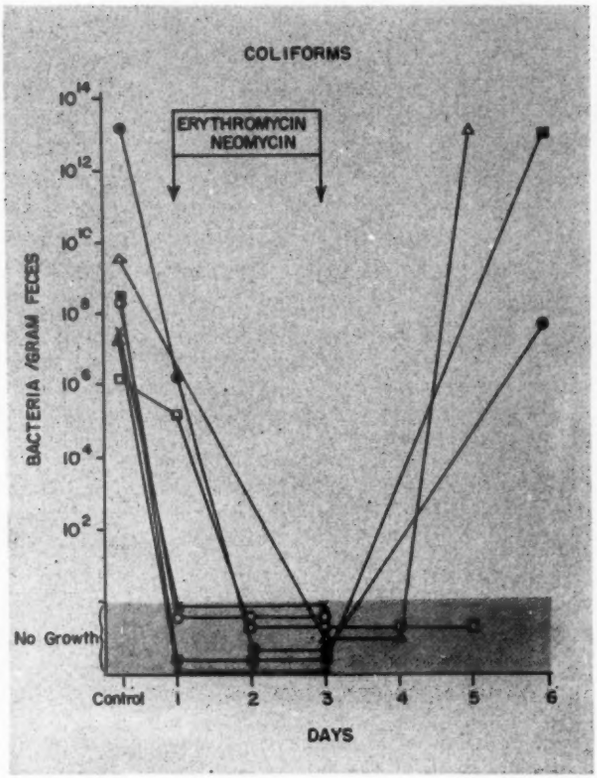

FIG. 4. Coliform organisms in feces during and after erythromycin-neomycin therapy.

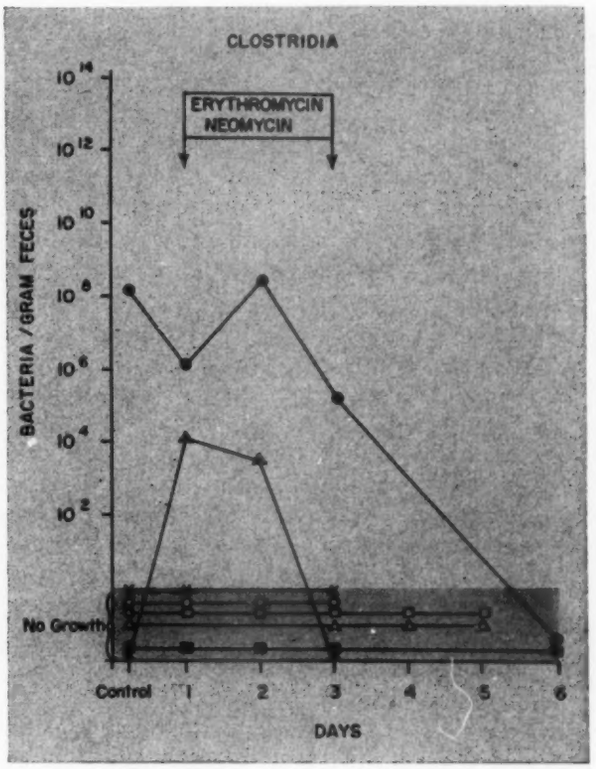

FIG. 5. Effect of erythromycin-neomycin therapy on clostridia in stool.

hours for seventy-two hours. Seven patients were studied.

Erythromycin in combination with neomycin has previously been used for preoperative intestinal antisepsis and the results reported following one day of therapy [*12*]. These authors believe this gave satisfactory reduction in the flora of the stool and they presented figures giving total bacterial counts during this period. We have favored a longer period of preoperative preparation and therefore decided to re-evaluate the problem on the basis of a seventy-two–hour period of therapy.

Streptococci, present in all control specimens, were absent from all but two patients after the first day of therapy. (Fig. 2.) Streptococci were not found in any patients at the end of therapy. They continued to be absent for two days after cessation of therapy in two patients and were recovered on the third day after therapy in two other patients.

Staphylococci were found in three control specimens and were eliminated from two by the first day. (Fig. 3.) Staphylococci were not subsequently found in any patients during therapy.

Coliform organisms were found in all control stools and were eliminated from four after one day of therapy. (Fig. 4.) By the end of preparation, coliform organisms were absent from all patients. Coliform organisms reappeared on the second and third days after therapy in one and two patients, respectively.

Clostridia were present in only one control specimen and were not eliminated from this patient. (Fig. 5.) Clostridia were present on the first and second days of therapy in one additional patient but were not found at the completion of therapy in this patient.

Bacteroides were found in all control specimens and were removed from five patients after one day of therapy. (Fig. 6.) They were not subsequently cultured from any patients during or after therapy.

Yeasts were not recovered from any control specimens but began to increase after the first day of therapy. (Fig. 7.)

Pseudomonas were found in two patients, aerobic gram-positive rods in three patients and alcaligenes in one.

Sensitivity studies included six different concentrations of antibiotics (Table II): (1)

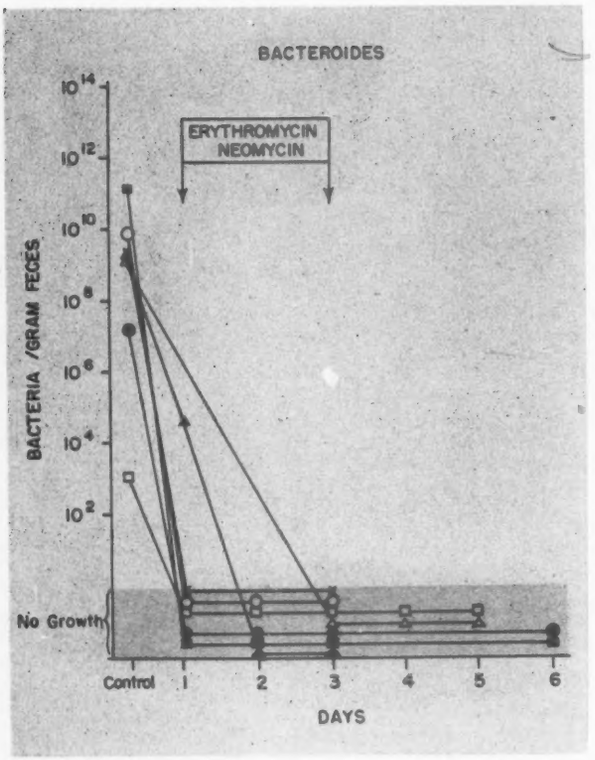

FIG. 6. Bacteroides in feces during and after erythromycin-neomycin therapy.

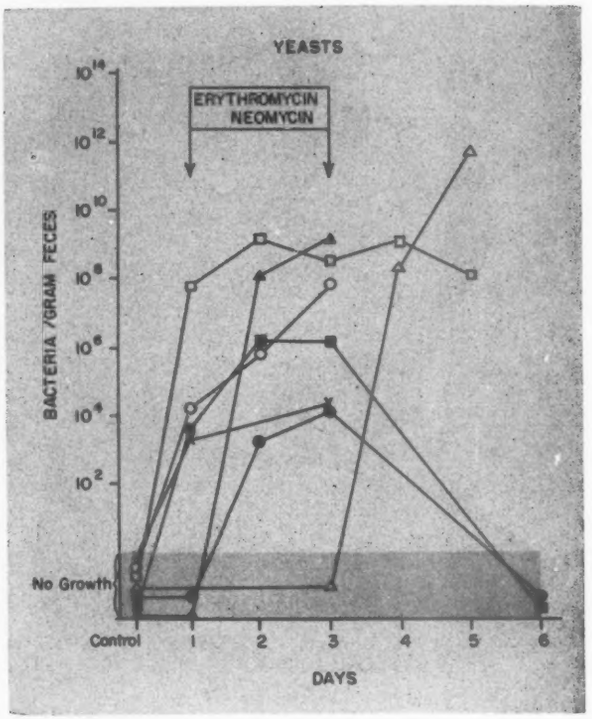

FIG. 7. Effect of erythromycin-neomycin therapy on yeasts in stool.

5 μg. of erythromycin; (2) 50 μg. of erythromycin; (3) 5 μg. of neomycin; (4) 50 μg. of neomycin; (5) 5 μg. each of erythromycin and neomycin; and (6) 50 μg. each of erythromycin and neomycin. There is no evidence of any sensitive strain becoming resistant during therapy. Sensitive organisms disappeared during therapy. In addition, some strains that disappeared were resistant to the higher concentration of antibiotics against which they were tested.

It was observed that any organism sensitive to either drug alone was also sensitive to the same concentration of drug when the drugs were combined. Under these circumstances, there would appear to be no further value in evaluating sensitivity to the drug combinations, since the same information can be obtained from the study of the two agents separately.

All except one strain of streptococci tested was sensitive to the lower concentration of erythromycin. Three patients had streptococci resistant to the higher concentration of neomycin. All streptococci were sensitive to the lower concentration of the drug combinations.

All specimens of staphylococci tested were sensitive to 5 μg. of erythromycin. One strain was resistant to neomycin but all others were sensitive to 5 μg. of neomycin. All staphylococci were sensitive to both antibiotic combinations.

Coliform organisms from all but one patient were resistant to the lower concentration of erythromycin. Six patients had strains sensitive to the higher concentration of erythromycin. All except one had coliform organisms sensitive to 5 μg. of neomycin. All except one were sensitive to the lower concentration when the two drugs were combined, and this one was sensitive to the higher concentration.

All clostridia tested were sensitive to 5 μg. of erythromycin but most were resistant to neomycin. All were sensitive to the lower concentration of the drug combination.

Most bacteroides tested were sensitive to erythromycin although one patient had resistant bacteroides. Bacteroides were evenly divided between sensitive and resistant strains when tested against neomycin. The sensitivity for the drug combination parallel those for erythromycin alone.

Comments. The satisfactory and rapid disappearance of streptococci, coliform organisms and bacteroides, plus the control of staphy-

lococci in those patients in whom they were found, make this one of the more satisfactory combinations for preoperative preparation of the colon. It is not possible to evaluate the response of clostridia because of their absence from the majority of patients throughout the study. The growth of yeasts would suggest that adequate control of the bacterial flora was obtained.

The sensitivity studies and the effective control of the bacterial flora of the colon indicate that the combination of erythromycin and neomycin compliment each other effectively and make one of the most desirable combinations yet studied for preoperative preparation of the colon.

The importance which is currently attached to the development of a micrococcic enteritis following broad-spectrum antibiotic therapy suggests on the one hand that this is an ideal combination since erythromycin is particularly effective against the staphylococci [*11*], but on the other hand that the routine use of such a combination might lead to the establishment of a bacterial flora in the hospital patient population that might not be responsive if such a complication did develop. While we have not yet experienced any of the difficulties reported with the various types of enteritis from antibiotic therapy, we would still be hesitant to recommend this type of therapy for *general* adoption. As preoperative therapy in a patient who has been on prolonged antibiotic therapy, this combination might prove useful in reducing the number of strains that have become resistant to the antibiotic previously being used. In view of the possible development of resistant strains, this combination might prove to be an ideal one for the postoperative intraluminal injection which we have advocated [*1,9,10*].

TABLE II

ERYTHROMYCIN-NEOMYCIN: SENSITIVITY TO 5 AND 50 μG. OF DRUG BEFORE AND AFTER THERAPY

Patient	Streptococci				Staphylococci				Coliforms				Bacteroides				Clostridia			
	Before		After		Before		After		Before		After		Before		After		Before		After	
	Erythromycin	Neomycin	Erythromycin	Neomycin	Erythromycin	Neomycin	Erythromycin	Neomycin	Erythromycin	Neomycin	Erythromycin	Neomycin	Erythromycin	Neomycin	Erythromycin	Neomycin	Erythromycin	Neomycin	Erythromycin	Neomycin
Bel.	S[5]	R	NS	NS	S[5]	R	NS	NS	S[50]	S[5]	NS	NS	R	R	NS	NS	NG	NG	NS	NS
Ben.	S[5]	R	NS	NS	NG	NG	NS	NS	R	S[50]	NS	NS	S[5]	R	NS	NS	NG	NG	NS	NS
Cha.	S[5]	S[5]	NG	NG	S[5]	S[5]	NG	NG	R	S[5]	NG	NG	[illegible]		NG	NG	NG	NG	NG	NG
Heb.	S[5]	S[50]	NG	NG	NG	NG	NG	NG	R	S[5]	S[50]	S[5]	S[5]	R	NG	NG	NG	R	NG	NG
Ros.	S[5]	R	S[5]	S[5]	S[5]	S[5]	S[5]	S[5]	S[50]	S[5]	S[50]	S[5]	S[5]	S[5]	NG	NG	S[5]	NG	NG	NG
Tay.	S[50]	S[5]	S[5]	S[5]	NG	NG	S[5]	S[5]	S[50]	S[5]	R	S[5]	S[5]	S[5]	NG	NG	NG	NG	NG	NG
Tho.	S[5]	S[10]	NS	NS	NG	NG	NS	NS	R	S[5]	NS	NS	S[10]	R	NS	NS	NG	NG	NS	NS

NOTE: See Table 1 for explanation of abbreviations and symbols.

SUMMARY

1. Erythromycin alone is not a satisfactory agent for preoperative preparation of the colon.

2. Erythromycin-neomycin is one of the most effective combinations yet studied for preoperative intestinal antisepsis. The possible complications which might result from the routine use of this combination have been discussed.

Acknowledgments: Erythromycin was supplied as erythrocin® by Abbott Laboratories, North Chicago, Illinois.

Bacteriologic determinations were conducted by Bette M. Beauclair, B.S. and Esther C. Alexander, B.S.

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Pheochromocytoma in Children

REVIEW OF SIGNIFICANT SURGICAL ASPECTS AND REPORT OF THREE ADDITIONAL CASES

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To date, thirty cases of pheochromocytoma have been reported in children under the age of fourteen [*1–26*]. In the more recent reports, newer concepts of diagnosis and operative removal, as well as the hazards of certain investigative procedures, have been discussed. A review of the collective experience indicates, however, that certain aspects of the diagnosis and treatment of these tumors need to be emphasized. It is the purpose of this report to discuss these factors and to present three additional cases in children.

CASE REPORTS

CASE 1. A. C., a thirteen year old girl, was hospitalized for investigation of stomach pain and headaches intermittently present for six months and blurred vision of two months' duration. One month earlier a diagnosis of hypertension with retinopathy had been made. There was a history of heat intolerance, excessive perspiration particularly at night for one year, intermittent nocturia for three months, and palpitation for two months. No abdominal pain was reported.

On physical examination, the patient appeared to be well developed, well nourished and mature. She was perspiring freely. Externally the eyes were normal. Funduscopically the disk showed 2 diopters of edema with arteriolar spasm and scattered hemorrhages. A systolic murmur was heard over the entire precordium, loudest at the second interspace. Pulse was 92; blood pressure was 220/160. Femoral vessels pulsated normally.

Laboratory studies revealed a hemoglobin of 13.8 gm. per cent and 11,100 white blood cells per cu. mm. with a normal differential. The sedimentation rate was 18 mm. per hour (Wintrobe). Urinalysis revealed the following data: specific gravity, 1.028; pH, 6; albumin, 2 plus; sugar, negative; acetone, negative; 5 to 8 red blood cells and 1 to 2 white blood cells per high dry field. The non-protein nitrogen was 33.6 mg. per cent and creatinine was 1.8 mg. per cent. Urinary ketosteroids were 5.8 mg. in twenty-four hours. No change in blood pressure was demonstrated by either the postural or pressor tests. Special urinary studies revealed a phenolsulfonphthalein of 45 per cent in fifteen minutes and 80 per cent in forty-five minutes. Addis count revealed 400 cc. of urine. The specific gravity was 1.26; pH, 6-0; proteins, 80 mg.; 800,000 red blood cells, 1,200,000 white blood cells and no casts. Second Addis count showed: proteins, 80 mg.; specific gravity, 1.028; red blood cells, 5,500,000; white blood cells, 1,800,000; and granular casts, 100,000. The urea clearance test was 51.5 per cent.

X-rays of the heart, lungs and skull were normal. Intravenous and retrograde urograms revealed a bilateral double pelvis. The electrocardiogram was a normal record consistent with left ventricular hypertrophy.

The patient withstood the various diagnostic procedures well except for periods of anxiety, hyperventilation and perspiration. After a complete survey it was believed that the child had essential hypertension, and consequently a Smithwick operation was performed. Left supra- and intradiaphragmatic sympathectomy was performed. Immediately after transection of the nerve, blood pressure dropped to 40/20 and temperature rose to 42.6°C. Despite all supportive measures, the patient died six hours after operation.

Autopsy revealed a 7 mm. tumor in the left adrenal gland and a 3.5 by 3.2 cm. nodule in the right adrenal gland.

CASE II. S. B., a thirteen year old white girl, was admitted to the hospital for investigation of progressive impairment of vision and marked frontal and occipital headaches, intermittently present for six months and accompanied by irritability, palpitation and shortness of breath. The patient had also had numerous stomach aches associated with occasional nausea and vomiting. There had been no increase in perspiration and no unusual intake of fluids.

On physical examination the patient appeared to be lethargic but otherwise well developed. The skin was normal and there was no increase of moisture. Mild bilateral papilledema was present, with exudation from the retina on the left side. The arteries appeared thickened, aud there seemed to be slight A-V indentation. The heart was not enlarged and there were no murmurs. Pulse rate was 120. Blood pressure in the arm varied from 180–220/140–170. Blood pressure in the lower extremities was 220/160. Massage over the adrenal areas failed to change the blood pressure. Rectal examination disclosed no abnormalities, and the extremities were normal.

Red blood count, hemoglobin and white blood count were within normal limits. Examination of the urine revealed an occasional hyaline cast and red blood cell. Blood urea was 12 mg. per cent.

A plain x-ray of the abdomen and chest was entirely normal. Intravenous pyelograms revealed good function bilaterally. On the right there was marked clubbing of the calices and infundibulum and moderate dilatation of the pelvis. The ureter was dilated and tortuous down to a point 2 cm. above the bladder where the ureteral lumen narrowed down to 2 to 3 mm. Concentric with this narrowing there was an external pressure defect on the lateral aspect of the bladder, symmetric with the ureteral orifice. The bladder was within normal limits. The upright film showed poor drainage of the upper urinary tract. Retrograde pyelography was then carried out and the aforementioned findings were confirmed. No obvious cause for the obstruction could be determined.

Blood pressure obtained with the patient lying down was 218/144; she was then placed in the erect position and blood pressure fell to 160/140. When blood pressure was 220/150, 2½ mg. of regitine® were given intravenously. One minute later her pulse was 140 and blood pressure 150/100. Blood pressure remained at this level for five minutes; after ten minutes it was 170/120, and after twenty minutes 180/138.

The patient was operated upon through an upper transverse abdominal incision. Close examination of both adrenals and the retroperitoneal area failed to reveal any tumor. However, in the pelvis two tumors could be palpated. The upper abdominal incision was therefore closed and a lower midline incision was made. Through the exposure gained with this incision, a 5 by 4 cm. tumor was found imbedded in the bladder wall. The lesion, which had exerted pressure on the right ureter, was removed by excising a part of the bladder. The bladder was subsequently closed without interference with ureteral function. The second tumor, which measured 4 by 3.5 cm., was excised from the lateral aspect of the true pelvis between the internal and external iliac vessels.

During the operative procedure the patient's blood pressure remained fairly stable. No fluctuation was noted with manipulation of the tumors. After the first tumor was removed, blood pressure fell from 180–200/140 to 120/80 where it remained until the second tumor was removed, and then dropped to 90/50. Administration of a solution containing one ampule of nor-epinephrine (4 cc. of .2 per cent solution) in 1,000 cc. of 5 per cent glucose with water was then started. Within twenty-four hours, blood pressure had stabilized at 108/80, only to rise three days later to 140/80. At the time of discharge on the eighth postoperative day, blood pressure was 122/80.

The patient's postoperative course was completely uneventful except for oliguria during the first thirty-six hours postoperatively. Thereafter urinary output was normal. The patient has remained entirely well since operation.

CASE III. R. W., an eight and a half year old white boy, was admitted to Children's Hospital of the East Bay for investigation of progressive headache, abdominal pain, nausea and occasional vomiting, associated with polydipsia, polyuria and profuse sweating. Symptoms had been present for approximately one to one and a half years.

Examination following admission revealed a

thin, tense and irritable child with cold, moist and clammy skin. The eyes were normal externally and endoscopically, except for some spasm of the retinal artery. The heart was slightly enlarged, but the rhythm was normal and there were no murmurs. The pulse rate usually ranged near 120. Blood pressure varied from 180–280/140–160. Blood pressure in the extremities was 260/140. Lungs were clear. The abdomen was flat and contained no masses. Massage of the abdomen failed to cause any change in the blood pressure. The extremities had a peculiar reddish blue discoloration and were slightly edematous.

Laboratory studies revealed a hemoglobin of 17 gm. per cent 6,000,000 red blood cells per cu. mm. and 9,800 white blood cells per cu. mm. with a normal differential. Urine was entirely normal except for 1 plus albumin. Blood chemistry studies showed 139 mEq. of sodium, 5.8 mg. per cent of potassium and 1 mg. per cent of creatinine. Phenolsulfonphthalein showed 35 per cent in the first half hour and 55 per cent in the first hour. Glucose tolerance test revealed a fasting glucose of 96 mg. per cent, 249 mg. per cent the first half hour, 270 mg. per cent the first hour, 230 mg. per cent the second hour, and 85 mg. per cent the third hour.

X-rays of the skull and intravenous pyelograms were interpreted as normal. Electrocardiograms revealed changes indicative of left ventricular hypertrophy.

With blood pressure at 220/140, 2 mg. of regitine were given intravenously. In a minute and a half, blood pressure dropped to 130/84, in two minutes to 118/70, and in thirteen minutes it was still 124/90. Piperoxin® also caused a drop in blood pressure. After intravenous administration of 9½ mg., blood pressure dropped from 190/60 to 120/90 in one minute, to 145/120 in three minutes, to 175/115 in five minutes, and in nine minutes it had returned to normal, 180/140. Urinary catechols were increased approximately five times normal.

With the patient under general anesthesia, a transverse upper abdominal incision was made. Bilateral adrenal tumors were found. The tumor on the right, which measured 4 by 2.5 by 2.5 cm., was a hard, solitary mass, the greater portion of which was under the vena cava. The lesion on the left side was nodular and consisted of three 2.5 by 2.5 tumors loosely adherent to each other. Although compression of the adrenal gland was apparent, the tumors were excised without greatly disturbing the gland.

The course of operation was essentially uneventful. With the induction of anesthesia, blood pressure dropped from 180 to 140 but returned rather promptly to 180/140. Manipulation of the tumors did not affect blood pressure. After the first tumor had been removed, blood pressure gradually fell over a fifteen-minute period from 180 to 140/110, where it remained stable for approximately thirty minutes. When the second tumor was removed, blood pressure fell precipitously to 95/60. When this initial drop occurred, intravenous hydrocortone was given (100 mg. to 500 cc. 5 per cent glucose in water). The blood pressure then remained stable during closure.

Approximately two hours after operation blood pressure began to drop, and consequently administration of nor-epinephrine was begun, using 8 cc. of .2 per cent nor-epinephrine with 500 cc. 5 per cent glucose and one-half normal salt. Thereafter, intermittent administration of nor-epinephrine solution was necessary to maintain the systolic blood pressure around 100. Thirty-six hours after operation the blood pressure had stabilized at 110–120/60–80. Administration of hydrocortone was continued intravenously for three days postoperatively, during which time ACTH was started and continued for five days.

The postoperative course was quite uneventful. Puffiness of the extremities disappeared and the color became normal. The patient's appetite began to improve and he had no further headaches or sweating. The patient is now apparently normal in all respects. Blood pressure has remained at 110/60, pulse is 90, and the cardiac size has returned to normal.

COMMENTS

Androgenic tumors are not limited to the site of the adrenal glands but may arise wherever chromaffin tissue occurs. The tumors of adrenal origin causing hypertension are referred to as pheochromocytomas. Those of extra-adrenal origin have been termed paragangliomas. However, many of the latter are non-functioning, and hence all tumors of chromaffin origin causing hypertension are now generally classified as pheochromocytomas.

The basic pathologic change is essentially that of chronic adrenal intoxication. The pressor substances liberated by these tumors con-

sist of two catechols, epinephrine and nor-epinephrine. Generally, the nor-epinephrine content predominates and this substance may be the primary cause of episodes of paroxysmal hypertension. Nor-epinephrine is a vasoconstrictor and has little or no effect on heart rate or cardiac output. Epinephrine is a vasodilator and increases blood pressure by increasing cardiac output [4]. Variations in clinical manifestations may be attributed in part to the relative proportions of these liberated catechols in circulation.

TABLE I
INCIDENCE OF MULTIPLE PHEOCHROMOCYTOMA*

	No. of Cases	Per cent
Unilateral	17	52
Multiple	16	48
Bilateral adrenal	8	24
Extra-adrenal	7	21

* Among thirty-three cases reported in children.

In the cases of pheochromocytoma reported in children, the tumors were smooth or lobulated and well encapsulated, and varied in size from 5 mm. to 28 cm. Carcinomas were rare. Of particular importance from a surgical standpoint is the fact that multiple pheochromocytomas may occur, and both adrenal and extra-adrenal tumors may be present in any patient. Thus, as indicated in Table I, in sixteen (48 per cent) of the reported cases, the tumors were multiple. Failure of blood pressure to fall after removal of one tumor suggests the presence of one or more additional lesions.

In some instances the adrenal gland may be compressed to a thin shell by the pheochromocytoma. In others the tumor may be joined to the adrenal gland by only a small pedicle. The tumors of extra-adrenal origin may be located anywhere in the body, although the bifurcation of the aorta (organ of Zuckerkandl) is the most common site. In seven (21 per cent) of the cases reported in children, the tumor was not associated with the adrenal gland. (Table II.) Extra-abdominal pheochromocytomas, however, have not been found in children. In adults, both intrathoracic and intracranial pheochromocytomas have been reported [27,28].

On gross examination, androgenic tumors vary from pale grey or pink to brown in color. Microscopically, the adrenal and extra-adrenal pheochromocytomas resemble adrenal medulla. Pathologic diagnosis is confirmed only by a positive chromaffin reaction. When chrome salts are present in the fixative, positive cells are stained brown. There seems to be no correlation between the size or microscopic appearance of the tumor and the amount of pressor substance liberated; the quantity of the liberated catechols cannot be ascertained without chemical assay.

TABLE II
LOCATION OF EXTRA-ADRENAL PHEOCHROMOCYTOMA*

Author	Case No.	No. of Tumors	Site of Tumors
Snyder and Vick [22]	3	2	1. Near bifurcation of aorta 2. Foraman of Winslow, independent of adrenal
Snyder and Vick [22]	2	2	1. Left adrenal 2. Medial to left adrenal, independent of adrenal
Hubble [9]	1	4	1. Right adrenal 2. Left adrenal 3. Anterior to aorta, near right adrenal 4. Anterior to aorta, superior to three other tumors
Cahill [3]	1	2	1. Left adrenal 2. Preaortic area superior to pancreas; removed at second operation
Espersen and Dahl-Iversen [5]	2	1	1. Anterior to aorta and vena cava near left adrenal
Iseri et al. [10]	1	1	1. Medial to lower pole of kidney, renal artery anterior and superior
Clausen	3	2	1. Bladder wall near right ureterovesical junction 2. Right lateral pelvic wall between internal and external iliac vessels

* Among thirty-three cases reported in children.

Clinical Manifestations. The characteristic clinical feature of pheochromocytoma is hypertension, either paroxysmal or persistent, although the latter may indicate a more advanced stage. The symptomatology, which has been described in detail in recent reviews [4,17], includes headaches, nervousness, anxiety, hyperhidrosis, weakness, visual disturbances, abdominal pain with nausea and vomiting, weight loss, polydipsia and polyuria. Many of these complaints are paroxysmal in nature and are precipitated by excitement and anger. The

patients are often malnourished, tense and irritable. Peripheral vasomotor changes are sometimes striking. The hands and feet may be exceedingly moist, yet cold, and often have a bluish red discoloration. This finding is particularly predominant in children. Episodes of profuse nocturnal sweating are frequently reported.

Other findings are those one would associate with hypertension with cardiorenal vascular changes. Hypermetabolism is indicated by a tendency toward a diabetic blood sugar curve and increased basal metabolic rate. Urinary findings characteristic of advanced renal-vascular disease may be present.

Diagnostic Procedures. Of the reported cases in children, radiologic examination resulted in successful visualization of the tumor in fourteen (42 per cent). Intravenous urography was informative in seven cases. Perirenal air or oxygen proved of value in demonstrating a tumor in seven of thirteen cases. In three instances, however, this procedure was abandoned because of a severe reaction. As has been noted, multiple and extrarenal tumors were often present in the reported cases. (Tables I and II.) This frequent multiplicity and bizarre location would suggest that the information to be gained does not warrant the latter procedure. Recently, aortography has been employed successfully in establishing diagnosis [*23*].

During recent years several new diagnostic procedures have been developed which have been of great value in augmenting clinical and roentgenologic data. One such test which has proved helpful in diagnosis of pheochromocytoma has been the quantitative determination of catechols in urine [*29,30*]. In patients with persistent hypertension, an increase in urinary catechol output can usually be demonstrated provided the test is well controlled. However, abnormal amounts may not be present during the normotensive period.

Chemical quantitation of epinephrine and nor-epinephrine in plasma has shown promise [*31*]. Elevation of these catechols has been demonstrated in patients with persistent hypertension and also in normotensive patients whose blood pressure has been elevated by provocative drugs. Further experience will be required before this test can be regarded as equivocal, but results reported thus far have been encouraging.

Another approach to diagnosis has been to evaluate the effect of certain adrenolytic drugs on blood pressure. Of these andrenogenic blocking agents, the two most frequently employed are benzodioxane and regitine [*32,33*]. When given intravenously, benzodioxane reduces the elevated blood pressure caused by pheochromocytoma. False positive and false negative results have been recorded, however. Regitine (phentolamine methane sulphonate) likewise has been employed in the reduction of high blood pressure caused by pheochromocytoma. This drug may be given intravenously, intramuscularly or orally. Occasional false positive and false negative results have also been recorded with its use, so that these tests cannot be regarded as altogether infallible. Since its stabilizing effect on blood pressure is sustained for several hours, regitine can be employed not only for diagnosis but also therapeutically during the preoperative period as well as during operation. Dibenamine® has also been used as an adrenogenic blocking agent, but the side effects (nausea, weakness, tachycardia, dizziness and tremor) have caused many investigators to discard it.

Another aspect of the pharmacologic approach to diagnosis has been the use of certain drugs (histamine, tetraethyl ammonium chloride and mecholyl®) as provocative agents to elevate blood pressure by stimulating secretion of the pressor compounds of the tumor. In patients with paroxysmal hypertension, these preparations may be of value. They must always be used with caution, however.

With the help of these newer pharmacologic tests, a diagnosis can now usually be made preoperatively. Certainly the use of hazardous procedures seems less justifiable in view of the effectiveness of other diagnostic procedures. However, in special instances, the use of regitine may reduce the danger of certain diagnostic procedures.

Surgical Aspects. A review of the literature and of the foregoing case reports indicates that certain aspects of the operative procedure are of particular importance if surgical removal is to be successful.

In the operative approach to pheochromocytoma in children, several factors suggest that the abdominal incision is superior. First of all, the tumors are frequently multiple. Moreover, the location may be such that the lesion cannot be reached through a flank incision. Occasionally the tumor will be so involved with major

vessels that the transabdominal exposure will be necessary. Most children with pheochromocytoma are small and thin, so that exposure of the lesion is usually not difficult. In four instances in which a flank incision was used, the presence of other tumors necessitated reoperation or resulted in the death of the patient.

TABLE III
PREOPERATIVE DEATHS FROM PHEOCHROMOCYTOMA*

Authors	No. of Deaths	Location of Tumor	Comment
Neill and Smith [19]	1	Bilateral adrenal	Patient died during anesthesia for diagnostic study
Goldfarb [7]	1	Bilateral adrenal	Patient died during attempt to release fecal impaction
Kremer [13]	1	Bilateral adrenal	Patient died before diagnosis established
Evans [6]	1	Unilateral adrenal	Patient died before diagnosis established
Klein et al. [11]	1	Unilateral adrenal	Patient died before diagnosis established
Berkheiser and Rappoport [2]	1	Unilateral adrenal	Patient died before diagnosis established

* Among thirty-three cases reported in children.

Anesthesia will cause increased amounts of catechols in the plasma [29] and consequently an initial rise in blood pressure can be expected after anesthetization. Pheochromocytomas should be handled gently because of the severe reaction which manipulation may precipitate. Ligation of veins early during the dissection is desirable. Hypertensive reactions may be controlled during operation by the administration of regitine. Careful dissection will preserve the adrenal gland, so important when the disease is bilateral. If the blood pressure does not drop precipitously after removal of one pheochromocytoma, the presence of another tumor should be strongly suspected. The use of regitine during the operation may mask manifestations of a second tumor, and consequently it should be reserved for those patients exhibiting unusual or severe reactions throughout the operation.

Postoperatively, hypotension may be very troublesome. In many cases the use of nor-epinephrine has been of value in handling this problem since nor-epinephrine is usually the

TABLE IV
POSTOPERATIVE DEATHS*

Author	No. of Deaths	Cause of Death	Operative Notes
Espersen and Dahl-Iversen [5]	1	Cardiac failure 6 hr. after operation	Tumor not located through flank incision
Snyder and Vick [22]	1	Uncontrolled hypotension 2 hr. after operation	Unilateral adrenal tumor removed
Talbot et al. [25]	1	Cardiac failure	Bilateral adrenal tumors located transabdominally; were to be removed through flank incisions later
Weiman et al. [26]	1	Uncontrolled retroperitoneal sepsis	Unilateral adrenal tumor removed
Hubble [9]	1	Hypertensive crisis and cardiac failure	Bilateral adrenal tumors and two preaortic tumors not removed because of severe hypertensive reaction during surgery
Beard et al. [1]	1	Cardiac failure	Unilateral adrenal tumor not removed
Linneweh [14]	1	Cardiac failure	One adrenal tumor removed and another found in opposite adrenal at autopsy
Seelemann [21]	1	Cardiac failure	Right adrenal tumor removed through flank incision; left adrenal tumor found at autopsy
Clausen	1	Cardiac failure	Bilateral adrenal tumors found at autopsy following Smithwick procedure

* Among thirty-three cases of pheochromocytoma reported in children.

predominant catechol. In some instances, however, epinephrine is the major catechol and epinephrine may be essential to maintain a sufficient blood pressure. If the tumor is adrenal in origin and particularly if bilateral lesions are found, the use of adrenal steroids may be necessary and preoperative preparation should be considered. Cortisone may make the vascular bed more responsive to nor-epinephrine. Nor-epinephrine or epinephrine may be necessary for twenty-four to forty-eight hours postoperatively.

Results of Treatment. Among the reported cases in children the mortality rate was high (54 per cent). Six children died before operation—four died before the diagnosis was established and two during minor procedures. (Table III.) It is evident that the slightest disturbance may sometimes precipitate a fatal hypertensive collapse. The operative mortality rate was 44 per cent. Three patients died during operation from severe hypertension and circulatory collapse. Our present knowledge of the use of regitine would perhaps enable us to avoid such catastrophes. Nine patients died in the postoperative period. Some of the fatal complications encountered in this group could now be prevented. (Table IV.)

With further development of the methods of diagnosis and treatment described, the results of treatment of pheochromocytoma should be far better in the future.

SUMMARY

1. The important aspects of pheochromocytoma in children have been reviewed and three additional cases reported.

2. Of the cases reported in children, multiple pheochromocytomas were present in sixteen (48 per cent). In seven cases (21 per cent), the tumor was not associated with the adrenal gland.

3. Diagnosis can usually be made clinically. The employment of hazardous diagnostic procedures would seem unwarranted.

4. Regitine has proved of considerable value in the prevention of hypertensive crisis before and during operation.

5. In the surgical removal of pheochromocytoma in children, the transabdominal incision is the approach of choice.

6. Failure of blood pressure to fall after the removal of one tumor suggests the presence of another tumor.

7. The value of nor-epinephrine and epinephrine in the control of postoperative hypotensive states is established. Steroid therapy, especially in cases of bilateral adrenal tumors, must be considered.

8. The mortality rate in the cases which have been reported in children was 54 per cent. The operative mortality rate was 44 per cent. These results should improve with further development of the methods of diagnosis and treatment described.

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Struma Lymphomatosa (Hashimoto's Disease) in Children

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FOLLOWING Hashimoto's description of this disease in 1912, a number of case reports appeared in the literature during the succeeding twenty years. However, there remained considerable doubt as to whether this disease was a definite entity or an early stage of Reidel's struma.

After publication of a detailed study of chronic thyroiditis by Graham and McCullagh [4] in 1931, the disease was established as an entity. They emphasized certain qualitative and quantitive changes in the thyroid epithelium. In an analysis of 114 cases of chronic thyroiditis they found twenty-four cases which met their criteria.

In 1947 Lehman and Maiden [7] reported twenty-three cases. The average age of their patients was forty-one years, all being female. Their youngest patient was sixteen years of age.

Marshall and Meisner [8] were able to make a pathologic diagnosis in 144 cases from a total of 31,661 thyroid operations. In their series, 585 were classified as chronic thyroiditis. The average age of their patients was 52.2 years, the youngest being a fifteen year old girl. In reviewing the literature, they found that Joll recorded the case of a ten year old girl, and Statland et al. reported on two girls, aged ten. Marshall and Meisner further stated that, to their knowledge, these were the youngest patients yet reported.

In 1954 Gribetz et al. [5] reviewed the literature and found eleven cases in pre-adolescent girls. Two of these patients were seen at nine and a half years of age, one at ten, two at eleven and one at thirteen. Surgical exploration was performed upon four patients and two underwent needle biopsies. According to their histories, goiter developed between six and ten years of age. There was a family history of goiter in two patients. No symptoms were recorded except dysphagia which was present in one patient. In their report the ages at which the biopsies and surgical exploration were performed were not recorded. Three were nodular in character and three showed enlarged Delphian lymph nodes.

PATHOLOGY

Grossly, the gland is usually found to be symmetrically enlarged, firm, grayish in color and lobulated. At operation it is seldom found to be adherent to the surrounding structures. Vascularity is diminished. In the adult the gland may weigh in excess of 100 gm.

Microscopic examination shows marked lymphoid infiltration, fibrosis and degenerative changes in the epithelium with the acini containing very little colloid. Graham [3] has stated that unusual quantities of lymphoid tissue alone are not sufficient for establishing a diagnosis of struma lymphomatosa since this tissue occurs in many other types of goiter. Furthermore, he said there is no single specific feature with regard to the lymphoid tissue or the epithelial changes which can be considered pathognomonic of the condition. He also made the following comment: "It is only when the entire clinicopathological picture is considered that a reasonably reliable interpretation can be made."

Crile [1] believes that acidophilic degeneration of the epithelium is the distinguishing feature. Joll [6] describes large acidophilic cells with excessive granular protoplasm and hyperchromatic nuclei. He believed these were degenerative changes. Stalker and Walther [9] believes the diagnosis should rest upon epithelial changes rather than the lymphoid tissue present.

In summarizing the microscopic findings in struma lymphomatosa, Marshall and Meisner made the following comment: "It is a diffuse

enlargement of the thyroid with atrophic follicles and round cell infiltration, at times accompanied by mild fibrosis." They also found eosinophilic epithelium lining the acini which contained a scant amount of colloid.

DIAGNOSIS

The usual history is that of a progressive enlargement of the thyroid over a period of one or two years with mild pressure symptoms. It usually affects women of middle age. Palpation of the gland usually reveals that it is symmetrically enlarged, and firm but not tender. In some cases the enlargement may involve one lobe to a much greater degree than the contralateral lobe. Fatigue is a common complaint in adults. Often signs and symptoms of hypothyroidism are present.

A differential diagnosis between this condition and malignancy may be difficult at times. This is particularly true when the enlargement is asymmetric in a child or in a male patient. Experience has shown that one can seldom rule out early malignancy of the thyroid by the history and physical examination alone. Therefore, biopsy by surgical exploration or by needle puncture is often necessary to establish the diagnosis.

TREATMENT

If one were able to make a positive diagnosis in all cases of struma lymphomatosa by the history and physical examination, many patients with the disease could be treated satisfactorily without surgery. When the enlargement is asymmetric or when it occurs in a child, as stated previously, surgery in some form seems mandatory.

Prolonged treatment with large doses of thyroid extract has been reported to cause regression of the goiter in many instances. Crile [2] does not consider struma lymphomatosa a surgical problem. He reports that with needle biopsy the diagnosis is made in 95 per cent of his patients. All are treated with thyroid extract, the usual dose being 3 gr. (180 mg.) daily. I have employed this form of treatment in a few patients who had undergone lobectomy or partial thyroidectomy with questionable regression of the persistent or recurrent goiter. However, the dose of thyroid extract was not kept at the point of tolerance for a long period of time, as advocated by Crile. Radiation has been used without apparent benefit. As pointed out by Crile, thyroid extract has failed to establish the expected feeling of well-being in many adult patients.

Partial resection of both lobes and removal of the isthmus appears to be the generally accepted treatment in most cases. Although I have no experience with needle biopsy, this method of diagnosis would seem particularly desirable in young girls in whom an operative scar is disfiguring.

CASE REPORT

A nine year old girl was referred to me in December, 1954. Her parents reported that they had noted enlargement of her neck for a period of two years. In June, 1954, Dr. M. Y. Keith, her pediatrician, found her thyroid to be enlarged and irregular in contour. At that time she was given thyroid extract. When she returned to his office five months later, he found a definite increase in the size of her thyroid gland with small nodules in the region of the left upper pole. No symptoms such as pressure or pain were elicited.

My examination at that time was essentially the same as that just mentioned. The patient was a well developed and alert girl of nine. Clinically there were no signs or symptoms of hyperthyroidism or hypothyroidism. The thyroid gland was markedly enlarged, the left lobe being larger and more irregular than the right. In the region of the left upper pole small movable nodules could be felt which appeared to be enlarged lymph glands. The patient was given thyroid extract, 2 gr. (120 mg.) daily.

When the patient returned two months later it was noted that not only had the size of the gland failed to diminish but also the nodules in the left side of the neck had apparently increased in size. Since we were unable to rule out malignancy of the thyroid, exploratory operation was advised.

At operation, performed on March 1, 1955, an irregular and lobulated goiter was exposed, the left lobe being larger than the right. Upon section of the gland the cut surface showed a grayish, glistening appearance. In one area of the left lobe the gross appearance suggested a degenerative process. The gland was not attached to the surrounding structures but there were enlarged lymph glands lateral and inferior to the left lobe. Frozen section examination

FIG. 1. Shows marked lymphoid replacement of thyroid structure with germinal centers.

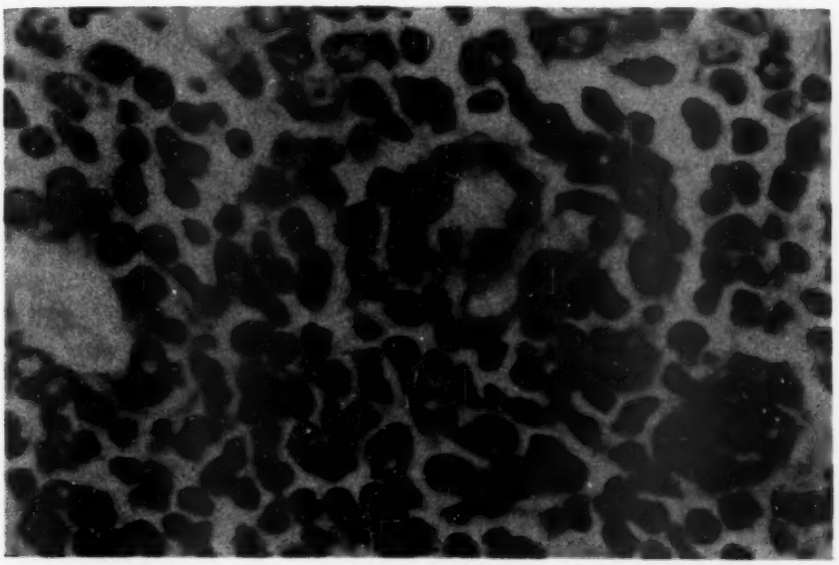

FIG. 2. High power view showing lymphocytic infiltration around small atrophic acini.

showed a lymphatic infiltration but no evidence of malignancy. Not being entirely satisfied with this examination, the left lobe and isthmus were removed.

Dr. H. C. Lennon rendered the following pathologic report: "Microscopic section of the thyroid gland reveals throughout a diffuse leukocytic infiltration. In the greater part of the structure the majority of the acini have been more or less crowded out of the picture. The ones that are present are fairly small and only a very occasional acinus contains colloid. There are rather large active germinal centers scattered throughout. There is some fibrous thickening of the stromal structure. This also shows evidence of leukocytic infiltration. The histological picture is fairly characteristic of a lymphomotosa struma or Hashimoto's disease. In some areas of the sections a few polymorphonuclear leukocytes are noted. There is no histological evidence of malignant change present in the sections." (Figs. 1 and 2.)

Follow-up observations on this patient have been interesting since there appeared to be some

regression in size of the remaining right lobe for one year postoperatively. However, upon examination eighteen months following the operation, there was a definite increase in the size of the right lobe even though the patient had been given 1 to 2 gr. of thyroid extract daily since the date of operation. The mother reported that symptoms of overaction of the drug seemed to take place if 2 gr. of thyroid extract were continued for a long period of time. Therefore, the dose varied from 1 to 2 gr. (60 to 120 mg.) daily for a period of eighteen months following surgery. During this time the patient has continued to develop normally, is alert and feels good. For the past three months the dose of thyroid extract has been 3 gr. a day with no apparent change in the size of the goiter during this period of time. On September 26, 1956, the blood cholesterol was 160 mg. and the protein-bound iodine 4.4 gamma per cent. Unfortunately, preoperative studies of this nature were not carried out. However, in five of the patients studied by Gribetz et al. protein-bound iodine values ran from 8.8 to 9.9. None of these patients showed signs or symptoms of thyrotoxicosis.

SUMMARY

A review of the literature on struma lymphomatosa (Hashimoto's disease) showed the disease to be rare in children.

Although an exhaustive review of the literature was not made, only two other case reports of struma lymphomatosa in children under ten years of age were found.

Operative and pathologic findings in a nine and a half year old girl, with postoperative observations over a period of twenty-three months, are presented.

The difficulty in making a differential diagnosis between struma lymphomatosa and carcinoma of the thyroid in children is emphasized.

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Ureteral Injuries in Pelvic Surgery

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INJURY to one or both ureters is a hazard which may occur during pelvic and abdominal surgery despite skill, experience and awareness of the surgeon. A true incidence of such surgical accidents is unknown, for there is a natural reluctance to record such misadventures, and others are never recognized. The risk of trauma to the ureter has increased with the applicability of extensive abdominal and pelvic dissections for cancer of neighboring organs, and one may assume that this application will be of even greater concern as the boldness of the surgeon develops. A review of the literature reveals an approximate total of 1,000 case records of unilateral and bilateral ureteral injuries. Most accidents have occurred during the course of gynecologic procedures, but colonic surgery has exacted a high toll. Extirpation of cervical carcinoma and extensions thereof accounted for the majority of recorded incidences of ureteral injury. Transabdominal and vaginal operative procedures have also been responsible for injuries when cancer was not the reason for performance of such surgery.

The high proportionate incidence of bilateral injuries may be explained, for these scarcely if ever escape notice, even though they may be misdiagnosed. Complete unilateral ligation, however, may cause insignificant symptoms and autonephrectomy results without clinical evidence of such a catastrophe. Newell [*16*] reported fifteen cases of ureteral injury, six of which were unsuspected but discovered at autopsy on patients who had died during the immediate postoperative period.

PATHOGENESIS

The close proximity of the ureter to the cervix and to the uterine artery is a most obvious cause of ureteral injury, particularly when the normal relationships have been grossly disturbed. The common offenders in this respect have been intraligamentous fibroids, intraligamentous ovarian cysts, pelvic inflammatory disease and infiltrating carcinoma.

FIG. 1. (Case II, Table IV.) Stricture 5 cm. up the left ureter. Subtotal hysterectomy performed twenty years previously.

During the course of radical hysterectomy with and without lymph node dissection, both ureters may be injured by clamping, cutting and ligation of vessels, especially when excessive hemorrhage is present. The destruction of an adequate blood supply to the ureters is perhaps significant as well. Such injuries may be particularly distressing, for the entire pelvic ureter may slough rendering reparative attempt impossible. Dodson [*5*] contends that usually

FIG. 2. Bilateral ureterogram showing normal position of the ureters.

FIG. 3. Uterine prolapse showing low position of lower end of the ureters.

FIG. 4. Uterine fibroid causing displacement of the left ureter.

the double vascular supply of the ureter is more than adequate to prevent such injuries. He bases his belief on the experience of urologists who often denude large areas of the ureters without consequence. The term "double supply" refers to the independent serosal and submucosal vascular trees, either of which is able to nourish the ureteral wall of itself. Michaels [*13*] has successfully injected the ureteral arterial supply with latex and has demonstrated a segmental type of arterial supply to each of the three parts of the ureter. The arteries lie in a fatty areolar capsule and divide into ascending and descending branches on reaching the ureter, with liberal anastomosis between the vessels of the three segments. These anastomoses involve the major long arteries and the encircling secondary branches to which they give rise. Perforating arteries arise from the secondary arteries which supply the mucosa but do not anastomose freely with each other. Therefore, although ureteral stripping may damage or remove completely the primary long arteries of one or more segments, this does not necessarily compromise the ureteral circulation because of the numerous anastomoses. Many gynecologists, including Meigs and Wertheim, believe that fistulas may develop despite avoidance of direct trauma to the ureter because of severance of blood supply. We subscribe to this assumption, being so persuaded by the delay of several days before some ureterovaginal fistulas arise following the pelvic surgery. Avascularization and ureteral slough could explain the time interval. Figure 1 demonstrates advanced ureteral dilatation and renal destruction which presumably was caused by ureteral injury during a subtotal hysterectomy twenty years previously. Such asymptomatic unilateral ureteral strictures result from partial clamping of the ureter or injury to the periureteral tissue, with consequent scarification without formation of an external fistula. Many injuries to the ureter of one side have resulted

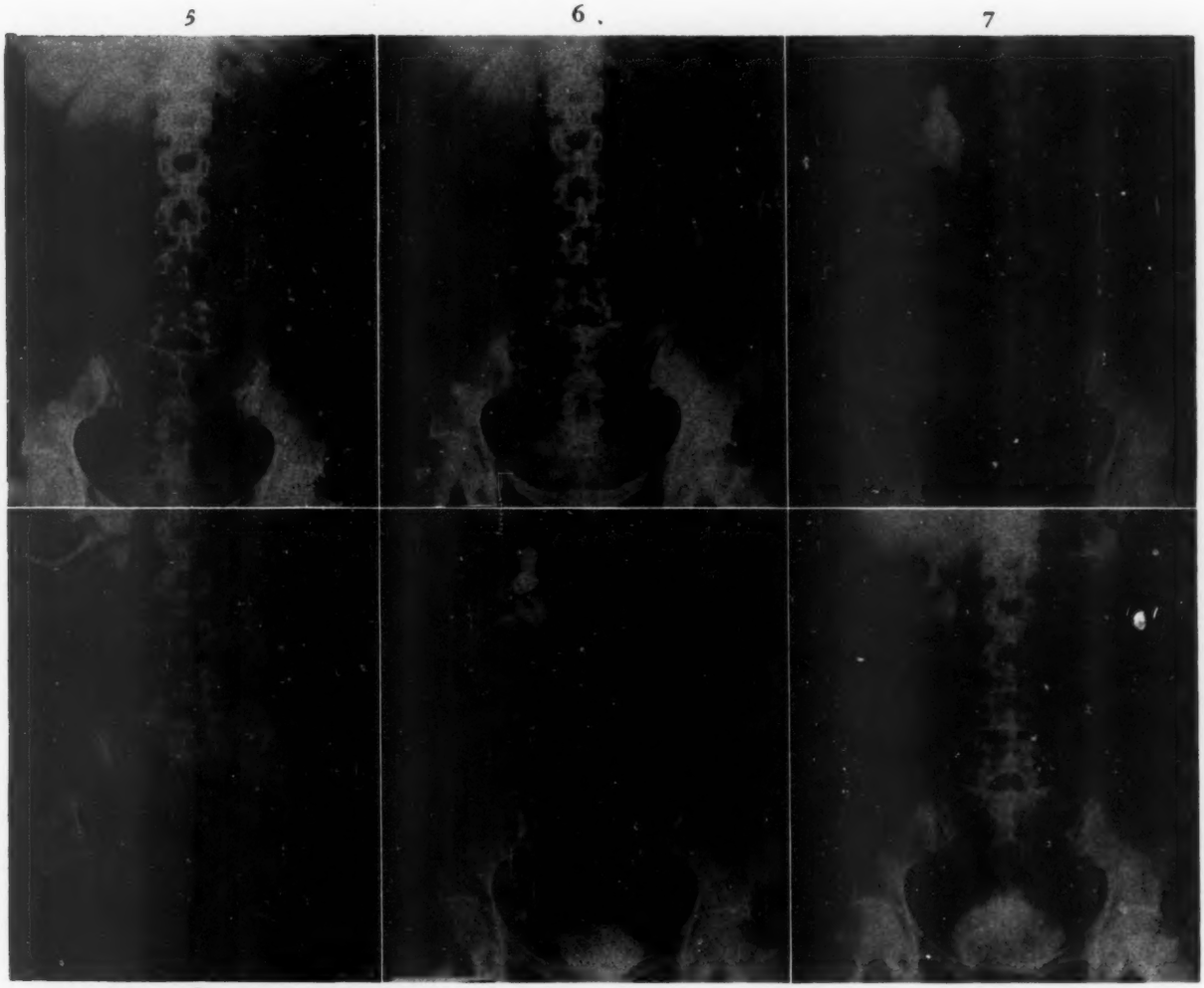

FIG. 5. (Case III, Table II.) Intravenous urogram four days after a vaginal hysterectomy showing a normal left kidney and no excretion of dye by the right kidney at the end of thirty minutes.

FIG. 6. (Case III, Table II.) No excretion of dye by the right kidney at the end of sixty minutes.

FIG. 7. (Case III, Table II.) Right nephrostomy tube injected with diodrast® shows normal filling of the right kidney and pelvis.

FIG. 8. (Case III, Table II.) Right ureter filled with dye but obstructed at the lower end and dye did not reach into the bladder.

FIG. 9. (Case III, Table II.) Right nephrostomy tube injected with diodrast ten days after a right ureterovesical anastomosis, illustrating good continuity between the ureter and bladder.

FIG. 10. (Case III, Table II.) Intravenous urogram one year after the right ureterovesical anastomosis showing normal morphology and function of the right kidney.

from partial clamping or injury of the tissues in the immediate vicinity, which when it heals results in scar formation with stricture and distortion of the ureter. In such cases, unless a fistula is formed, the injury will be recognized in the immediate postoperative period but will lead to renal damage.

Burch and Landy [4] advocate freeing of the uterine artery before ligation, so that it can drop well away from the cervix and ureter to avoid such vascular injury. If the ureter is carefully palpated at this point before tying the artery, many cases of ureteral obstruction by kinking can be avoided. A second, less obvious but perhaps more important suggestion is made. They state that the ureter frequently lies in close approximation to the posterior sheath of the opened pelvic peritoneum and, when closed,

FIG. 11. (Case v, Table 1.) A No. 9 F. catheter plugging lower end of left ureter; diodrast allowed to flow into the catheter by gravity outlines a left ureterovaginal fistula.

the ureter may be inadvertently included within the reperitonealizing suture. A similar potential hazard is encountered during the closure of the peritoneum following surgery upon the sigmoid and the rectosigmoid areas.

The ureteral injuries which follow vaginal repairs with or without vaginal hysterectomy may be explained by the degree of ureteral distortion which can accompany uterine prolapse. (Figs. 2 to 4.) Likewise, large cystoceles may occasionally displace the position of the ureter, exposing them to accidental trauma.

Millin [*14*] has emphasized the importance of the low intraluminal ureteral pressure. A large pelvic hematoma may compress the lumen and obstruct the ureters, causing anuria and death. He has described three cases in which bilateral ureteral obstruction was due to unsuspected pelvic hematoma.

DIAGNOSIS OF URETERAL INJURY

Persistent loin tenderness following a pelvic surgical procedure should at once arouse the suspicion that the ureter has been injured.

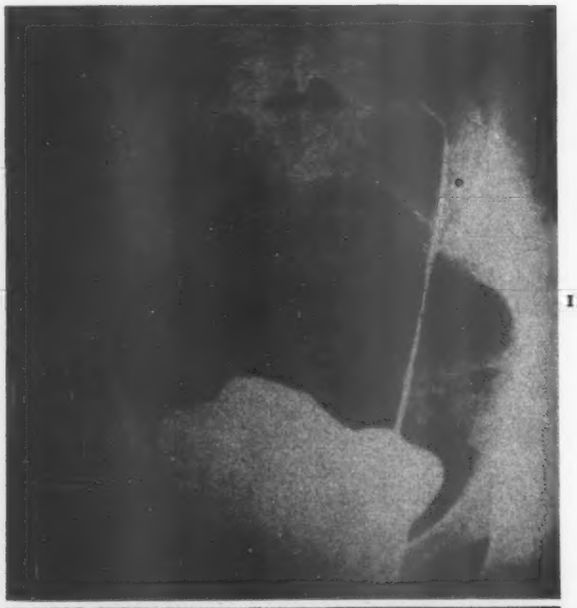

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FIG. 12. (Case II, Table 1.) Probe inserted into the left ureter per vagina.

FIG. 13. (Case II, Table 1.) Skiodan® injected into the left ureter refluxes through a fistula into the vagina.

These symptoms may subside, however, without the development of a fistula or significant elevation of the body temperature, and the patient may be discharged without knowledge of the loss of one functioning kidney. In the absence of infection the ureter can be completely ligated with minimal clinical disturbances. The important concern, however, is that such unrecognized renal destruction exposes the patient to grave consequences in the event the remaining kidney is eventually compromised.

Unexplained fever following a pelvic proce-

TABLE I

UNILATERAL INJURIES WITH FISTULA FORMATION (9 CASES)

Case No., Age and Sex	Pathology	Operation	Complication	Treatment	Result
I, 36, F	Uterine fibroid	Supracervical hysterectomy and bilateral salpingo-oophorectomy	Vaginal leakage 9th day; right ureterovaginal fistula	Right nephrectomy on 27th day	Recovered
II, 40, F	Uterine fibroid	Panhysterectomy	Left ureterovaginal fistula	Repeated ureteral indwelling catheters, 1 yr.; severe pyelonephritis	Recovered (Figs. 12 and 13)
III, 38, F	Pregnancy	Cesarean section	Vaginal leakage 11th day; right ureterovaginal fistula	Anastomosis 28th day; ureter not splinted	Good; minimal right hydronephrosis (Fig. 14)
IV, 42, F	Fibroids	Excision of residual cervical stump; left salpingectomy and oophorectomy (indwelling ureteral catheters)	Vaginal leakage 10th day; left ureterovaginal fistula	Anastomosis 3 mo. later	Good; normal intravenous urogram
V, 49, F	Fibroids	Total abdominal hysterectomy	Vaginal leakage 10th day; left ureterovaginal fistula	Repair 19th day; ureter freed and intubated	Minimal hydronephrosis; 5 yr. follow-up (Fig. 11)
VI, 37, F	Fibroids	Total abdominal hysterectomy	Vaginal leakage 3rd day; vesicovaginal fistula, and left ureterovaginal fistula not diagnosed	Repair of vesicovaginal fistula in 7 wk. Left nephroureterectomy 5 mo. later	Leakage continued Recovered
VII, 63, F	Carcinoma of rectum	Abdominoperineal resection	Perineal leakage 15th day; left ureteroperineal fistula	Nephrectomy	Recovered
VIII, 65, M	Carcinoma of rectosigmoid	Abdominoperineal resection	Perineal leakage 11th day; right ureteroperineal fistula	Right nephrectomy	Recovered
IX, 38, F	Fibroids	Total abdominal hysterectomy	Vaginal leakage 3rd day; persisted 2½ yr.; left ureterovaginal fistula	Repair; ureter freed; intubation; cystostomy	Good

dure should arouse the suspicion of an obstructed ureter. (Figs. 5 to 10.) Urinalysis may be of little diagnostic value since pus cells will not appear in the urine in complete obstruction of the ureter. The liberal use of antibiotics may maintain a sterile urine despite complete or partial ureteral obstruction. Ureteral injury rarely escapes attention when a urinary fistula develops. Leakage of urine from a fistula may appear at any time, although it is often delayed from ten to fourteen days. The site of injury is usually, but not always, easily located. Intravenous urography, instillation of colored solutions into the bladder, cystograms, cystoscopy

FIG. 14. (Case III, Table I.) Bilateral pyelograms one and a half years after a right ureterovesical implantation showing normal right ureter and kidney.

and retrograde pyelography are the usual methods of investigation (Fig. 11.) A complete urologic survey is essential, since both a ureteral and a vesical fistula may coexist.

Complete obstruction of both ureters and consequent anuria precipitate an alarming situation. At times, however, the anuria may be erroneously attributed to lower nephron nephrosis secondary to a transfusion reaction. Urologic investigation will help in the differential diagnosis.

IMMEDIATE REPAIR OF URETERAL INJURIES

A large variety of reparative procedures have been advocated for the correction of ureteral injuries first recognized in the immediate or late period of convalescence. The surgical procedure used will vary with the type of injury and each problem must be handled on its specific merits. It is not within the scope of this paper to enter into the complicated phases for choice of procedures for late repair, but they are best illustrated by the cases recorded in Tables I to V. A useful purpose might be served, however, if attention is directed to steps which should be taken if the injury is recognized at the operating table.

The fundamental objective involved in the correction of injury to the ureter is the preservation of the involved kidney, and secondly, re-establishment of the continuity of the ureter. Immediate recognition, at the time of surgery of ureteral trauma, may prevent subsequent complicated reparative procedures. Direct observation of the ureter will show ureteral dilatation in case of traumatic ureteral obstruction. If severance of the ureter is suspected, indigo carmine or a like substance injected intravenously will produce discoloration at the site of injury.

Once the site of injury has been determined, the procedure of choice is reanastomosis over a splinting catheter together with diversion of the urinary stream proximal to the site of anasto-

TABLE II

UNILATERAL URETERAL OCCLUSION WITHOUT FISTULA (THREE CASES)

Case No., Age and Sex	Pathology	Operation	Complication	Treatment	Result
I, 34, F	Abruptio placentae	Cesarean section	Occluded lower end of left ureter	Left nephrostomy 1 mo. after initial surgery; 2 wk. later ureter partially opened	Good; left mild hydronephrosis; stricture of lower 4 cm. of ureter
II, 34, F	Procidentia, single kidney	Anterior and posterior colporrhaphy	Ureteral obstruction; anuria; uremia	Immediate nephrostomy; ureter open 27 days later	Good
III, 50, F	Procidentia	Vaginal hysterectomy	Complete occlusion of lower end of right ureter, 3 cm.	Right nephrostomy on 12th postoperative day; anastomosis on 42nd postoperative day	Good; normal kidney (Figs. 5 to 10)

TABLE III

BILATERAL INJURY OF URETERS (FIVE CASES) WITH AND WITHOUT FISTULA

Case No., Age and Sex	Pathology	Operation	Complication	Treatment	Result
I, 45, F	Procidentia	Anterior and posterior colporrhaphy	Bilateral ureteral occlusion; anuria; uremia, erroneously attributed to mismatched blood	Bilateral nephrostomy on 7th postoperative day; 4 wk. later left ureter opened into bladder; right ureter occluded; vesical anastomosis without ureteral splint	Good; normal left kidney; right mild hydronephrosis (Fig. 16)
II, 64, F	Procidentia	Vaginal hysterectomy	Bilateral ureteral occlusion; anuria	Unsuccessful right deligation; at end of 24 hr. right ureterovesical anastomosis and ureteral intubation catheter expelled Another time left ureterovesical anastomosis; ureteral intubation and cystostomy	Abdominal urinary leakage for 2 wk., then subsided Good; bilateral moderate hydronephrosis (Fig. 15)
III, 49, F	Carcinoma of cervix	Deep x-ray therapy; indwelling ureteral catheters; radical hysterectomy	Vaginal leakage 5th day; bilateral ureterovaginal fistula	Bilateral nephrostomy 2 wk. after initial surgery; at a later stage bilateral Ockerblad procedure; ureters intubated with No. 5 F. polyethylene catheters; right ureter sloughed, requiring secondary nephrectomy	Normal left kidney and rectovesical fistula, repaired at later date
IV, 57, F	Carcinoma of rectosigmoid	Abdominoperineal resection	Bilateral ureteral occlusion; anuria; uremia	5th postoperative day, emergency bilateral nephrostomy; 6 wk. later right ureterovesical anastomosis; ureter intubated and cystostomy	Good

mosis. This will prevent urinary extravasation at the site of the anastomosis and reduce periureteritis, fibrosis and ultimate stricture formation. Diversion of the urinary stream is probably best effected by nephrostomy, but the kidney may not be accessible unless a loin incision is made or the abdominal wound enlarged to undesirable dimensions. In the absence of a nephrostomy or pyelotomy, a large lumen rubber No. 12–14–16 F. catheter may be placed in the ureter proximal to the site of repair and thence brought out to the skin. A second method utilizes a T-tube which would be placed in the ureter proximal to the site of repair with the distal arm of the T passing through the site of anastomosis. Both these methods entail the danger of a persistent urinary fistula following removal of the ureteros-

TABLE IV

INJURIES TO THE URETER WHICH RESULTED IN STRICTURE FORMATION

Case No., Age and Sex	Pathology	Operation	Complication	Treatment	Result
I, 49, F	Fibroids	Total hysterectomy	Severe stricture of lower end of left ureter; severe hydronephrosis	Left nephroureterectomy	Recovered
II, 47, F	Pelvic inflammatory disease	Supracervical hysterectomy	Severe stricture of lower end of left ureter	Repeated ureteral dilatations over several years; left nephroureterectomy	Good (Fig. 1)
III, 38, F	Carcinoma of cervix	Wertheim procedure	Stricture of lower end of left ureter	Repeated ureteral dilatation	Fair
IV, 38, F	Carcinoma of cervix	Wertheim procedure	Urine per vagina on 14th postoperative day	None; leakage stopped	Good; follow-up intravenous urogram normal

TABLE V

INJURIES TO THE URETER RECOGNIZED AT OPERATION

Case No., Age and Sex	Pathology	Operation	Complication	Treatment	Result
I, 53, F	Fibroids	Supracervical hysterectomy and bilateral salpingo-oophorectomy	Right ureter was accidently divided	Surgeon elected to ligate the proximal end of the ureter	Recovered
II, 52, F	Ovarian tumor; endometriosis	Excision of ovarian tumor	Left ureter cut accidently	Cut left ureter reanastomosed over a ureteral catheter; stricture repeatedly dilated	Stricture requiring dilatation

tomy tube at the site where the tube was inserted. Should this occur, closure of the fistula may be facilitated by cystoscopic insertion of a ureteral catheter.

A less efficient method of diversion involves the insertion of a simple splinting ureteral catheter passed to the renal pelvis and down into the bladder. A ureteral repair is done around the catheter. A cystoscope is then introduced and the catheter is grasped with forceps and brought out through the urethra. The failures in this method of reconstruction probably lie in the fact that the tip of the catheter does not remain in the renal pelvis or may be extruded entirely into the bladder before healing is completed. It is our belief that a splinting ureteral catheter should always be used in the anastomosis. The ureteral catheter should not be too large (Fig. 15), so that the internal circulation of the ureter is not compressed and the healing area not rendered ischemic. This should always be complemented by another catheter inserted above the site of anastomosis.

Should the ureteral injury be located near the bladder and recognized at the time of surgery, reimplantation of the ureter into the bladder is a good procedure. Cystostomy should always be performed to immobilize the bladder, for it is dangerous to depend on an indwelling urethral catheter to accomplish this mission.

Ureterointestinal transplantation may be

FIG. 15. (Case II, Table III.) Intravenous urogram illustrates bilateral moderate hydronephrosis. This patient had bilateral occluded ureters following vaginal hysterectomy. An attempt was made by a surgeon to deligate the right ureter but this was unsuccessful. A right ureterovesical anastomosis was performed with a poor result, as indicated by advanced hydronephrosis. At a subsequent time a left ureterovesical anastomosis was completed with somewhat less hydronephrosis.

FIG. 16. (Case I, Table III.) Intravenous urogram showing good function in both kidneys and dilated right renal pelvis. This patient had bilaterally occluded ureters following an operation for procidentia. Bilateral nephrostomy was performed. The left ureter opened up itself, and six weeks after the nephrostomy a right ureterovesical anastomosis was performed. This x-ray illustrates the excellent result obtained.

used as a last resort. One must bear in mind the frequent postoperative complications such as hydronephrosis, ascending infection and hyperchloremic acidosis. A few reports of cross or transabdominal anastomosis of the injured ureter to the opposite intact ureter have appeared in the literature [*9,19*]. This procedure seems hazardous in that it exposes the normal ureter to infection and stricture formation.

In the event a diagnosis of ureteral obstruction has been made within twenty-four hours after the completion of an abdominal operation, consideration may be given to reopening the primary incision and performing a direct deligation. This should never be attempted unless a large (Fig. 15) ureteral catheter has been inserted cystoscopically to the point of obstruction. Despite the attractive and tempting features of a direct approach, this may prove to be most unwise. The regional edema may so distort the anatomy that the ureter escapes identification even with a catheter in place. The patient must then be subjected immediately to another incision allowing exposure of the ureter at a higher location and at some distance from the operative site. This may prove to be a trying or even disastrous strain on a distressed patient. Consequently we are loath to attempt to deligate the ureter after twenty-four hours have passed and approach this consideration with some trepidation, even within this period. It must also be borne in mind that even if the ligature is removed, the residual injury may persist and a fistula develop. For this reason we advise a splint and diversion above the site of injury. (Fig. 16).

COMMENTS

It is our belief that the incidence of injuries to the ureters would be greatly lowered if the anatomic status of the urinary tract is determined prior to operation, either by means of intravenous urography or retrograde pyelography. That the insertion of ureteral catheters will substantially reduce the risk has been demonstrated by Sisk [*20*]. Accidents will be minimized if care is taken to identify the ureter before the uterine artery is clamped. The surgeon must also bear in mind the danger of occluding the ureter during the course of repairing the incision in the peritoneum. Immediate repair of the divided or injured ureter is advisable. This is best accomplished by insertion of a ureteral catheter to act as a splint, complemented by diversion of the urinary stream through the insertion of a rubber catheter at a point proximal to the anastomosis. If the injury to the ureter is close to the bladder, reimplantation of the ureter into the bladder with cystotomy is a procedure which is most likely to succeed.

CONCLUSION

In the management of ureteral injury sustained during abdominal and pelvic surgery, the results obtained in this series of cases would

seem to justify the method adopted. It is advocated that urinary diversion above the site of repair or anastomosis will provide most favorable results. In our series of twenty-three patients about one-third ultimately required nephrectomy, while various degrees of function were restored to the remainder. It is our intention, on another occasion, to enumerate in detail the management of ureteral fistula, and unilateral and bilateral ureteral occlusion.

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Fibrosarcoma of Bone

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FIBROSARCOMA is defined as a primary tumor of bone, the fibroblastic malignant cells of which produce no osteoid material. Many authors support the concept of the existence of this entity [*1,2,7,9–11*]. The lesion is closely related to some of the osteoid-producing malignant tumors (osteogenic sarcomas) which have a prominent fibroblastic component [*3*]. Several investigators have indicated that fibrosarcoma of bone has a significantly better prognosis than does osteogenic sarcoma [*1,9,10,11*]. Some have suggested that spindle cell tumors found entirely within bone are actually undifferentiated osteogenic sarcomas or chondrosarcomas and that they should not be called fibrosarcomas [*5*].

MATERIALS AND METHODS

Of more than 2,000 microscopically verified [*4*] primary tumors of bone encountered at the Mayo Clinic before 1955, only fifty were unmixed or pure fibrosarcomas. Tumors which are primarily of soft tissue and produce only slight erosion of the bone have been excluded from this study. Tumors which have involved bone and soft tissue approximately equally have been considered to be primary in bone, based on the premise that secondary extension into bone is mechanically difficult and not likely to be extensive. It became evident that if one excludes soft tissue fibrosarcomas which merely abut on or slightly erode a bone, no distinct group that could be definitely called "periosteal fibrosarcomas" would remain. Five fibrosarcomas of the mandible have been excluded from the study because of the special problems involved in the treatment of such lesions.

Unmixed fibrosarcomas proved to be relatively rare. Among the more than 2,000 primary tumors of bone from which these fifty examples were taken there were over 400 osteogenic sarcomas and approximately 200 chondrosarcomas.

TABLE I
INCIDENCE ACCORDING TO AGE IN DECADES

Decade	No. of Patients
0–9	0
10–19	7
20–29	8
30–39	14
40–49	6
50–59	9
60–69	6
70–79	0
Total	50

CLINICAL FEATURES

Twenty-three of the patients were males and twenty-seven were females. Their ages ranged from fifteen to sixty-nine years at the time of diagnosis; the average age was 38.5 years. (Table I.) The anatomic distribution of the fifty fibrosarcomas of bone concerned is shown in Table II. Thirty-four tumors were situated in the long bones, and 52 per cent of the entire group were found in the femur or tibia. More than 80 per cent of the lesions in the femur or tibia were situated near the knee. There was a distinct tendency toward involvement of the metaphyseal area of the long bones.

Ten patients had had previous treatment for benign giant cell tumor. (Fig. 1*a* and *b*.) The original therapy for nine of these patients had been curettage and radiation. Nine of the giant cell tumors had been verified histologically and

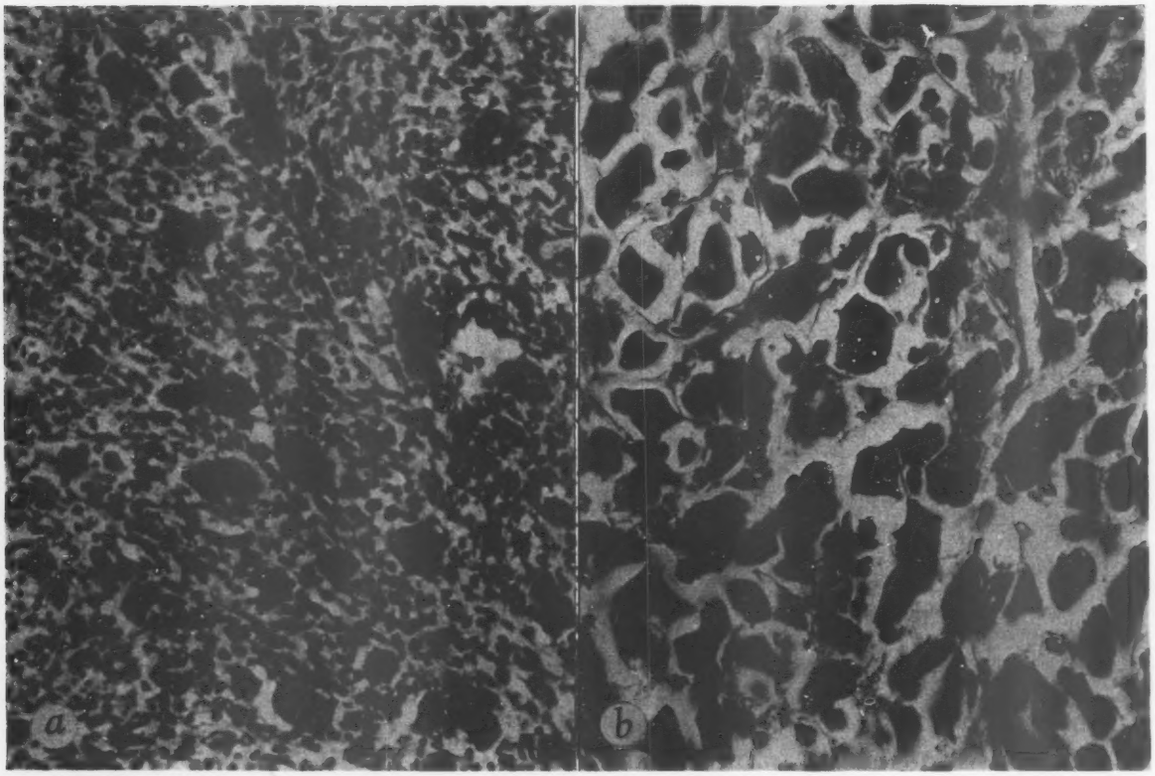

FIG. 1. (*a*) Benign giant cell tumor that was treated by curettage and radiation. Hematoxylin and eosin × 175. (*b*) Grade 4 fibrosarcoma replacing the giant cell tumor seen in *a*, four years after the original therapy. Hematoxylin and eosin × 500.

TABLE II
DISTRIBUTION OF TUMORS ACCORDING TO ANATOMIC SITE

Location	No. of Cases
Femur	15
Distal third (13 cases)	
Tibia	11
Upper third (9 cases)	
Pelvis	11
Sacrum (4 cases)	
Innominate bones (7 cases)	
Scapula	4
Humerus	4
Radius	2
Ulna	1
Fibula	1
Rib	1
Total	50

in seven instances the original slides of tissue were available for our review. The lesion of the tenth patient had been diagnosed roentgenologically as a benign giant cell tumor associated with a pathologic fracture. This patient had refused any form of therapy except the use of a brace; after fourteen years, during which the original lesion remained latent, he returned to the clinic with a fibrosarcoma in the same area. This period of latency was the longest in this study; the shortest was three and a half years. The average interval between the diagnosis of benign giant cell tumor and that of fibrosarcoma was eight and a third years. Those patients who received radiation therapy have been described in detail by Sabanas and associates [*12*].

Two additional fibrosarcomas apparently arose in benign tumors. Sections of one of these revealed areas of benign fibroma, and sections of the other contained zones of benign giant cell tumor. Neither of the two patients concerned had received previous therapy. Special sections were made around the peripheries of all the tumors in this study in which the total specimens were available. This search for evidence of pre-existing pathologic processes uncovered no additional tumors exhibiting any indications of a previously existing benign lesion of bone.

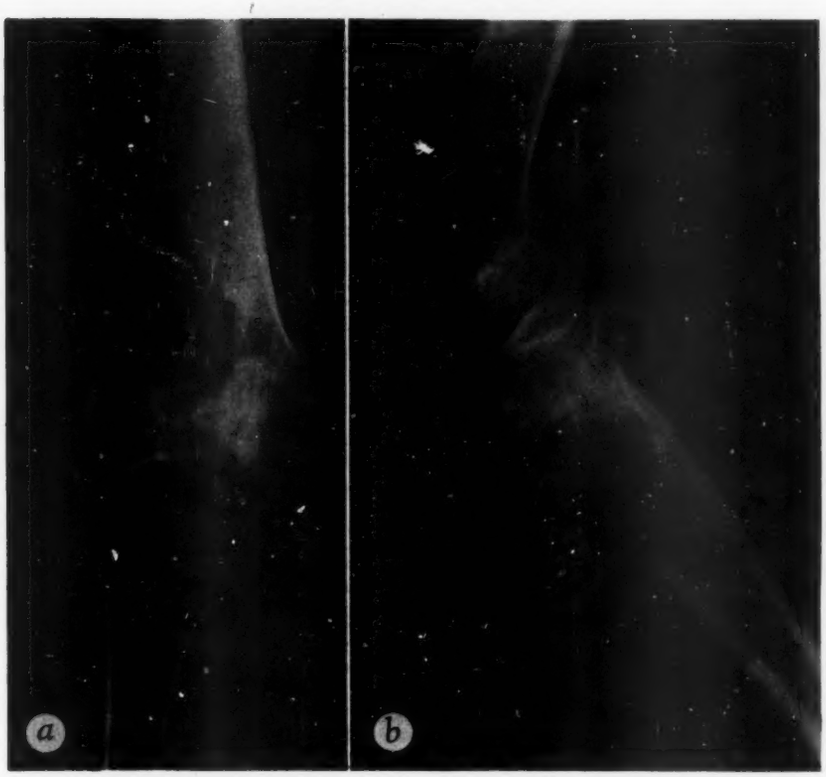

FIG. 2. (*a*) Fibrosarcoma of the lower end of femur. (*b*) Fibrosarcoma of the tibia.

SYMPTOMS

The presenting complaint of all patients was pain or swelling. All patients experienced pain, and pain also was almost always the first symptom. Swelling occurred in more than two-thirds of the patients. The tumors least likely to produce swelling were situated in bones concealed by large amounts of soft tissue, such as the pelvis. At the time the patients registered at the clinic, the average duration of pain was slightly more than a year and the average duration of swelling was slightly less than a year. In most instances general symptoms were not prominent at the time the patient was first seen.

PHYSICAL SIGNS

Local tenderness, with or without a palpable mass, was most frequently present over the involved area, and in some cases there was an increase in local heat. Several patients had limitation of motion of the extremity secondary to pain, and in some patients the tumor was in close proximity to a joint.

ROENTGENOLOGIC APPEARANCE

The roentgenologic picture of fibrosarcoma is not pathognomonic. The lesions are osteolytic, and in the early stages there may be only loss of the trabecular pattern if the process is limited mainly to cancellous bone. More advanced tumors show wider areas of irregular destruction characteristic of osseous malignancy. As the tumor enlarges, the periosteum may be elevated and there may be some reactive formation of new bone. Cortical destruction occurs; and as extension proceeds, involvement of soft tissues results. (Fig. 2*a* and *b*.) The roentgenologic appearance of fibrosarcoma is similar to that of an osteolytic osteogenic sarcoma. Chondrosarcoma, Ewing's tumor and reticulum cell sarcoma likewise can produce a similar roentgenologic picture; hence the diagnosis cannot be made solely on the basis of the roentgenologic appearance.

GROSS APPEARANCE

These tumors may be composed of a firm, fibrous, whorled mass of tissue or of soft,

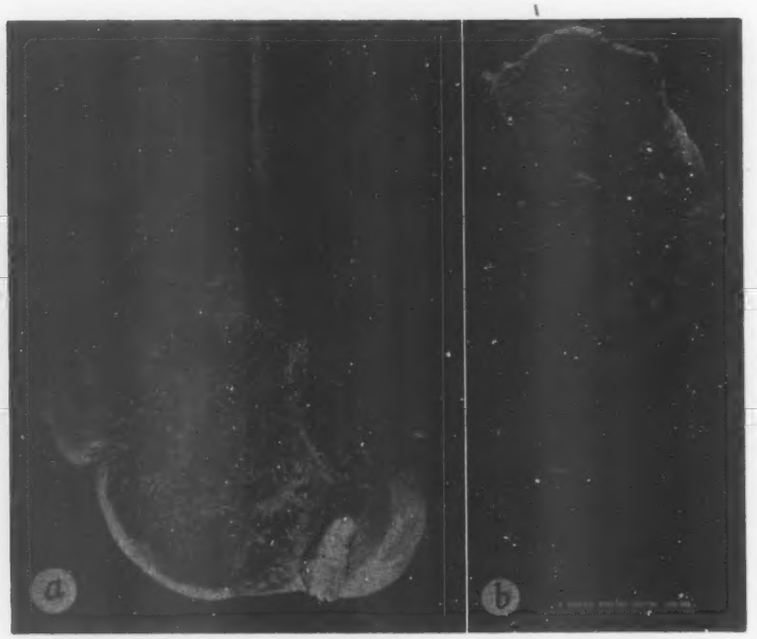

FIG. 3. (*a*) The tumor of the femur shown in figure 2(*a*). (*b*) The tumor of the tibia shown in figure 2(*b*).

fleshy tissue which invades the bone in an irregular pattern, although a few could be shelled out readily. There may be areas of necrosis and hemorrhage. Nearly all the tumors in this group had broken through the cortex, and the extraosseous portion was large or small. (Fig. 3*a* and *b*.) More than 90 per cent of the tumors were definitely medullary. Five of the tumors possibly may have originated in the periosteum, since these five had very large extraosseous portions, but four of these also had prominent intramedullary components. The lesions were characteristically ovoid; the longest diameter varied from 1.5 to 20 cm., and in most tumors the diameter was 6 cm. or more. In tumors involving long bones the longest diameter of the tumor nearly always involved the intramedullary portion, parallel with the long axis of the bone.

All except three of the tumors of long bones involved the metaphyseal area. In a few there had been a break through to the adjacent joint surface. Only one patient in the group had sustained a pathologic fracture.

MICROSCOPIC APPEARANCE

Fibrosarcoma in bone has the same histologic features as fibrosarcoma in soft tissue, except that it may be seen destroying bone. (Fig. 4*a* and *b*.) There is a wide variation in the degree of differentiation in the component fibroblasts and in the amount of collagen produced. The nucleus varies from oval to spindle-shaped, and may even be lobulated. The number of mitoses, the hyperchromatism and the nuclear irregularities vary, depending on the grade of the tumor, as does the amount of the intercellular collagenous substance. In the lower grade, better differentiated tumors, it is arranged in bands and whorls. Occasionally, when it was impossible to distinguish dense bands of collagen from osteoid material, the material was considered to be osteoid, and in such cases the lesion was not included in this series.

The tumors were graded according to the degree of differentiation, after the method of Broders. Two tumors were grade 1, fourteen were grade 2, twenty-six were grade 3 and eight tumors were grade 4.

DIFFERENTIAL DIAGNOSIS

Osteogenic sarcoma, especially when it is of a predominantly fibroblastic nature, may require multiple histologic sections for distinction from unmixed fibrosarcomas. The finding of even occasional foci of tumor osteoid material precludes the diagnosis of unmixed fibrosarcoma of bone. As will be discussed later, this distinction is chiefly of didactic importance.

Non-osteogenic fibroma is found among

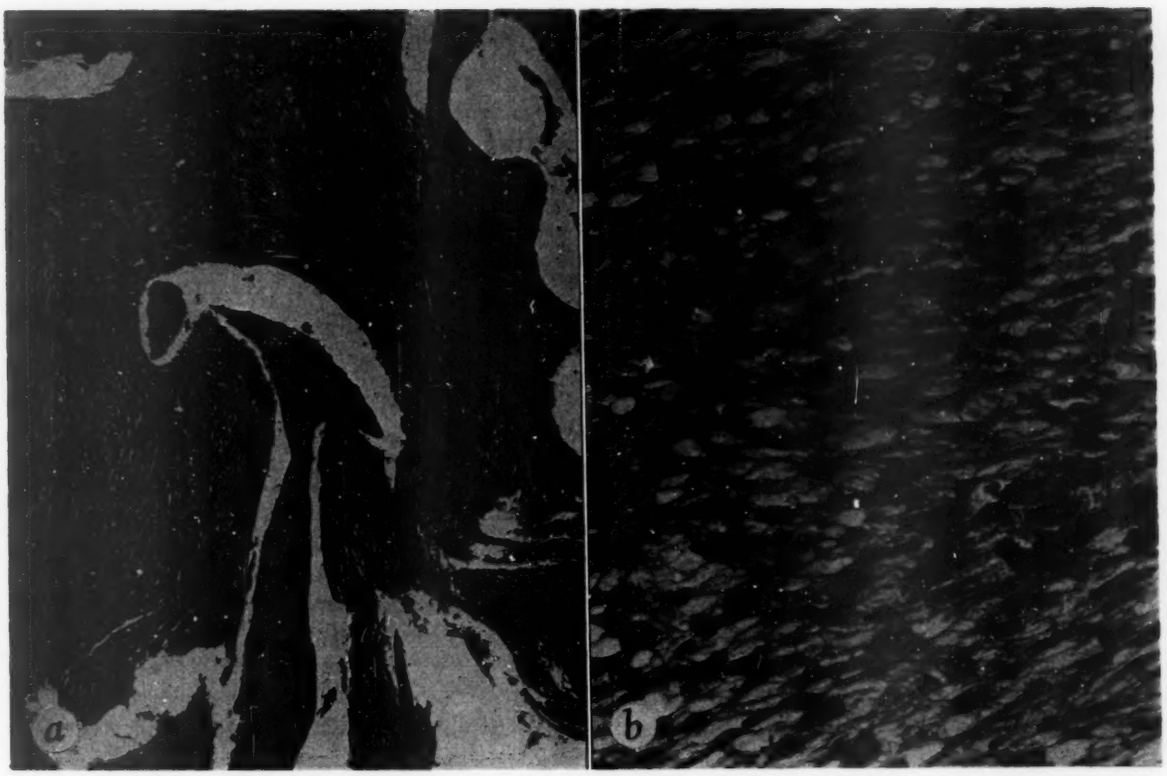

FIG. 4. (*a*) Fibrosarcoma destroying normal osseous trabeculae. Hematoxylin and eosin × 75. (*b*) Typical spindle-shaped nuclei of fibrosarcoma. Hematoxylin and eosin × 200.

members of a younger age group [*4,9*]. Roentgenologic examination characteristically reveals a well defined defect which usually is eccentric and often is lobulated. It occurs in the shafts of long bones at a variable distance from the epiphyseal line. The limits of the lesion are well demarcated, both roentgenologically and grossly. Microscopically, there are fibroblasts, some of which may exhibit mitoses. Lipophages often are present, as are variable numbers of benign multinucleated cells.

Fibrous dysplasia, when cellular, may pose a problem in distinction. The cells of the dysplastic process, however, do not possess malignant features, and the finding of irregular trabeculae of metaplastic osteoid material or bone establishes the diagnosis.

Recurrent giant cell tumors, and especially those which previously have been exposed to radiation, should be suspected of being fibrosarcomas at the time of recurrence, and adequate histologic study is indispensable.

TREATMENT AND RESULTS OF TREATMENT

Eight of the fifty patients were treated definitively after January 1, 1951, and thus are ineligible for inclusion in calculation of a five-year survival rate. Of the remaining forty-two patients, one could not be traced and eleven lived longer than five years, a five-year survival rate of 26.8 per cent. Three of the eleven patients who lived longer than five years, however, died of metastatic tumors in the sixth and seventh years after definitive treatment.

Biopsy alone was performed on five patients, all of whom died within two years thereafter; in fact most of them died long before two years. Most of these patients, by the time they arrived at the Mayo Clinic, had inoperable tumors or lesions from which specimens previously had been taken for biopsy.

Radiation therapy, after biopsy, was administered in seven cases. Six of the seven patients died of tumor within the first two years, and the seventh patient lived for 6.8 years before succumbing to the effects of the tumor.

Excision of a tumor of the lower end of the femur, including uninvolved bone above and the upper end of the tibia, resulted in a forty-three–year cure. Complete excision followed by radiation was performed on six other patients.

Four of these patients died within five years and one patient died in the sixth year, leaving one patient who lived beyond ten years. In this last case, frozen sections of the excised lower part of the humerus revealed the necessity for additional resection. Excision of an additional 3 cm. of the shaft of the humerus proved sufficient.

The largest group of patients, twelve, were treated by amputation alone. Seven of these patients died of the tumor within five years. Five survived five years and four of these patients are known to have lived more than ten years, one having been lost to follow-up study. Amputation, after preoperative radiation therapy, was performed as the treatment for seven patients, all of whom died of the tumor within the first five years. Several of these were patients whose lesions had progressed to a marked degree before any therapy was begun.

COMMENT

In accord with the views of most other authors, the authors of this review accept the concept that primary fibrosarcoma of bone is a definite pathologic entity. There is no good evidence in the series to indicate that periosteal fibrosarcoma, if such an entity exists, should be separated from the other fibrosarcomas of bone. This is in accord with the views expressed by Kolodny [*8*]. Some authors have considered periosteal fibrosarcomas to be accompanied by a reasonably good prognosis [*1,5,13*]. Five of our patients had lesions that might possibly be considered periosteal in origin; these lesions appeared histologically to be the same as the remainder of the fibrosarcomas, and all the five patients had a fatal outcome. Perhaps a few tumors which some observers would consider to be periosteal sarcomas were omitted from this series on the premise that they were of extraosseous origin and simply came into contact with bone incidentally. One of us (J. C. I. [*6*]) and Sullivan [*14*] have shown that fibrosarcomas of the soft tissues of the extremities are associated with an appreciably better prognosis than were the osseous tumors in our series.

All known deaths caused by tumor in this series occurred before seven years after treatment. The fact that three of the eleven patients who lived five years after definitive therapy subsequently died of the disease indicates the shortcomings of five-year survival data concerning fibrosarcoma of bone. If the three late deaths are subtracted, a survival rate remains that is not substantially different from that of osteogenic sarcoma.

Unmixed fibrosarcomas of bone constitute only 2 per cent of the primary tumors of bone recorded in the files of the Mayo Clinic. Adequate histologic sampling revealed that many tumors at first thought to be unmixed fibrosarcoma actually contained areas of osteoid production by tumor cells. These, then, by definition, would be classed with the osteogenic sarcomas.

When the similarity between the prognosis and histologic aspects of fibroblastic osteogenic sarcomas and pure fibrosarcomas is considered, and in view of the fact that the skeletal distribution of the two lesions overlaps remarkably, the impression is strong that the two are closely related entities. The relationship is accented by the feature that both are radioresistant and both ordinarily are of central origin. The only significant difference seems to be that pure fibrosarcomas affect persons of a distinctly older age group than do fibroblastic osteogenic sarcomas, and fibrosarcomas are more often secondary to pre-existing benign disease.

Twelve of this group of fifty fibrosarcomas gave evidence of having arisen in a benign tumor of the bone. Origin from a benign lesion is distinctly unusual in other osseous malignant tumors. Ten of these twelve secondary sarcomas occurred after long intervals of latency following therapy for proved benign giant cell tumors, and it is noteworthy that therapy in nine of the ten cases included the use of ionized radiation. This certainly emphasizes the fact that radiation is not without danger in the treatment of benign osseous disease.

As to the onset of symptoms, there was an average time differential of approximately six months from the onset of pain to the onset of swelling. This indicates considerable opportunity for earlier diagnosis in this disease. As patients become increasingly aware of the wisdom of seeking medical care for persistently painful areas and physicians make roentgenologic examinations sooner, the results of treatment should be expected to improve.

After analysis of this series, it is our opinion that amputation is the treatment of choice for this radioresistant tumor. We found no good

evidence that radiation therapy is of value. The value of study of fresh-frozen sections at the time of operation again should be stressed. The life of one patient in this group apparently was saved by the finding of tumor tissue in the intramedullary cavity at the proximal end of the line of excision and by the immediate resection of more bone to carry the line of excision above the site of the residual tumor tissue. This patient was still living twelve years later, at the time of this report. In addition, study of fresh-frozen sections allows prompt definitive therapy, which is always desirable in malignant disease.

SUMMARY AND CONCLUSIONS

Fifty cases of primary fibrosarcoma of bone have been reviewed. The tumor occurred most commonly among patients in the fourth decade of life. It affected long tubular bones in thirty-four of the fifty cases.

The danger of radiation therapy for benign disease is re-emphasized in the fact that nine of the ten patients with a history of benign giant cell tumor at the site of subsequent fibrosarcoma had received radiation therapy.

This study lends no support to the concept of periosteal fibrosarcoma as a specific entity.

Our study indicates that distinction of pure fibrosarcoma from the fibroblastic type of osteogenic sarcoma can be made on histologic grounds, but the distinction is chiefly of didactic significance.

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A Study of Cigarette Smoke and Cigarette Paper Smoke Alone

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From the Rand Development Corporation, Cleveland, Ohio. Presented at the Annual Meeting of the American Association for the Advancement of Science, Atlanta, Georgia, December 27, 1955.

THE clinical relationship between cigarette smoking and cancer of the lung is an important problem to society and to the medical profession. That there is a causal relationship

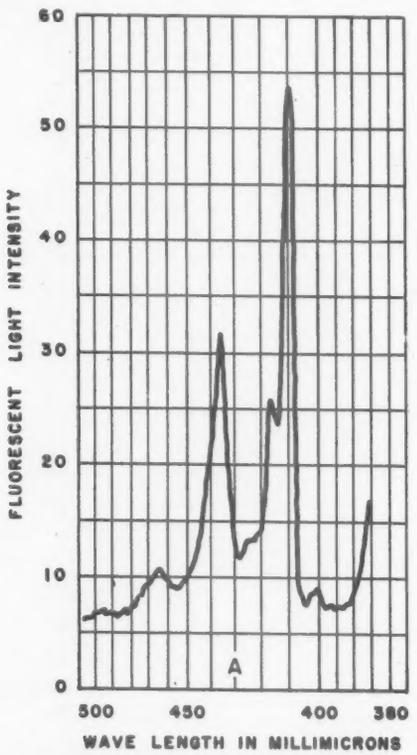


FIG. 1A. Ultraviolet fluorescent spectrum of 3:4-benzpyrene. The peaks in the fluorescing bands are at 410, 432 and 455 mμ with a small but distinct peak at 415 mμ on the shoulder of the 410 peak.

in the human was emphasized first by Adler in 1912 [1] (according to Wynder and Graham), by Ochsner and De Bakey [2a], by Wynder and Graham [3] and by others [4]. The clinical relationship of cause and effect is convincing and by some it is regarded as established fact. The literature based on clinical study is extensive. The laboratory or experimental data on this subject are much less extensive. We are reporting our experimental studies which were carried out in the period 1951 to 1955.

THE CARCINOGENIC PROPERTIES OF 3:4-BENZPYRENE

The carcinogenic properties of this substance were studied by Barry and his associates [5], Fieser [6] and by others. 3:4-benzpyrene is a potent carcinogen. It is a polycyclic hydrocarbon found in coal tar, chimney soot, diesel engine exhaust fumes and elsewhere. If a substance can be shown to contain 3:4-benzpyrene, that substance automatically becomes a carcinogenic substance. The cancer of the chimney sweep is well known. No one considers dosage in the soot necessary to produce cancer; the fact is that cancer occurs in the chimney sweep. If cigarette smoke can be shown to contain 3:4-benzpyrene, then cigarette smoke becomes a carcinogenic substance and dosage depends upon the amount of smoking and the concentration of this substance in the smoke.

EXPERIMENTS

Condensing Smoke. In order to test the smoke it is necessary to condense it. Cigarette smoke contains water, tar and other substances. A smoking machine simulates the act of smoking. The smoke is passed through acetone in which the tars dissolve. This tar solution is available for chemical analysis and biologic tests.

Separation of Tar into Its Components. This was done by the use of solvents. The first sol-

vent used was acetone because it dissolves many substances. Cyclohexane dissolves 3:4-benzpyrene along with other hydrocarbons, and was used to extract these substances from the acetone-water-tar solution. This cyclohexane solution is a complex mixture of substances

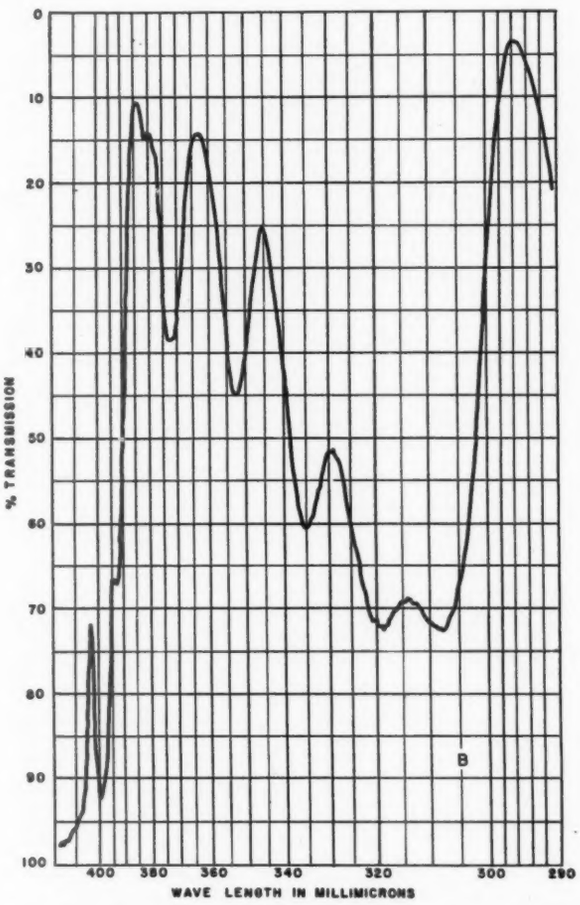


FIG. 1B. Ultraviolet absorption spectrum of 3:4-benzpyrene. The peaks are at 405, 385, 365, 347 and 298 mμ with a distinct shoulder on the low wave length side of the 385 peak.

which require further separation. This is accomplished by passing the solution through chromatographic columns containing non-reactive materials and solvents. According to our experiments silica gel (SiO_2) and alumina (Al_2O_3) as columns and benzene (C_6H_6) and cyclohexane (C_6H_2) as solvents yielded the purest substances for subsequent testing.

Identification of 3:4-Benzpyrene. This is done by use of the spectrophotometer. This substance has a characteristic ultraviolet fluorescent spectrum. (Fig. 1A.) The spectrum produced by this substance is not confused with any other substance when tested in relatively pure form. The ultraviolet absorption spectrum produced by 3:4-benzpyrene is also characteristic (Fig. 1B) and can be used to measure the amount of 3:4-benzpyrene present in the substance tested.

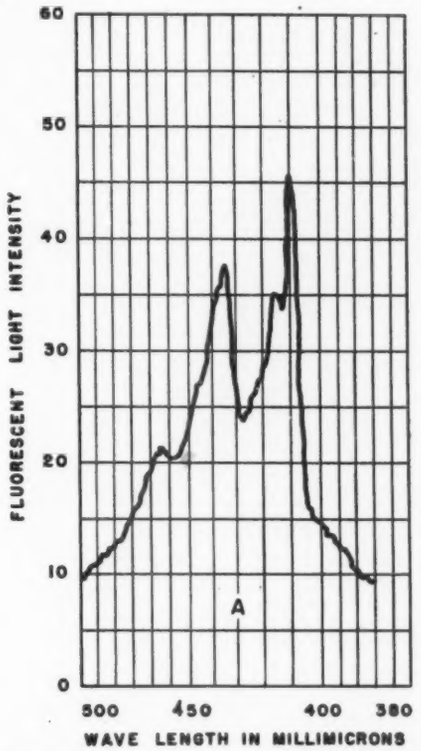


FIG. 2A. Fractions of tars of cigarette smoke. Ultraviolet fluorescent spectrum. The peaks are at the identical wave length of pure 3:4-benzpyrene, including the small peak at 415 mμ. The general shape and relative heights of the peaks are in the same order as in Figure 1A.

Spectrographic Analysis of Cigarette and Cigarette Paper Smoke-Tar Fractions. These two spectrographic methods were applied in a study of the various purified fractions obtained from the cigarette smoke tar. The ultraviolet fluorescent spectrum of these purified fractions is shown in Figure 2A and the ultraviolet absorption spectrum is shown in Figure 2B. Each spectrum identified 3:4-benzpyrene and the ultraviolet absorption spectrum showed it to be present in amounts of approximately 10 to 12 μg. per 100 cigarettes. A slight variation in quantity exists in different brands of cigarettes. No doubt some of the 3:4-benzpyrene is lost in extraction so that the quantity given here is probably less than the actual amount contained in the cigarette smoke. The tar obtained from

cigarette paper alone was tested and the ultraviolet absorption spectrum is shown in Figure 3. This spectrum resembles that of pure 3:4-benzpyrene. This work has been published in the *British Journal of Cancer* [7a].

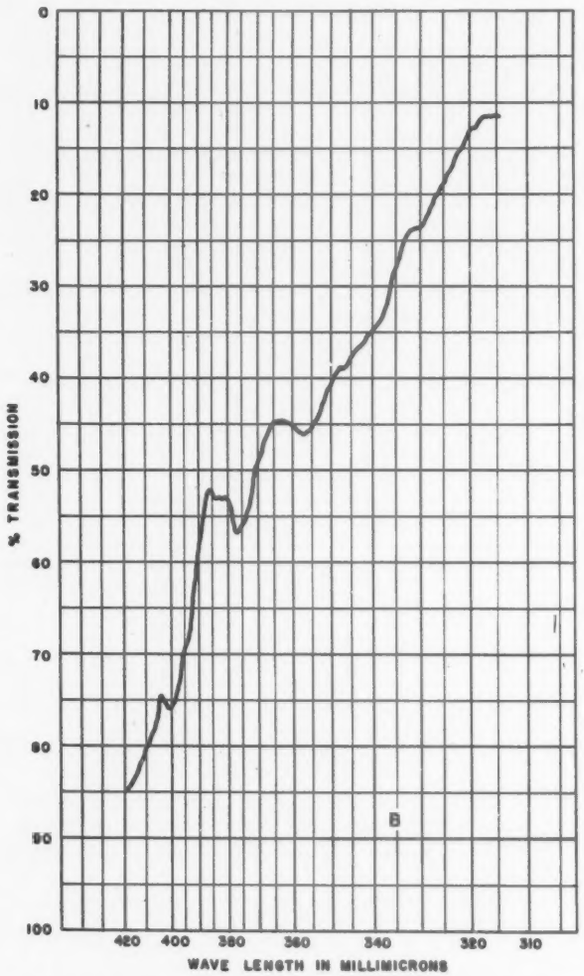


FIG. 2B. Fractions of tars of cigarette smoke. B, ultraviolet absorption spectrum. Peaks are present at 405, 385, 365 and 347 mμ with a shoulder at 380. Compare with Figure 1B.

Skin Tests on Animals. One of the accepted tests for carcinogenic activity consists of application of the substance to the skin of mice and observation of the effects. Substances containing 3:4-benzpyrene produce short term and long term reactions [5]. The short term (five days) reactions consist of hyperplasia of the epithelium, disappearance of sebaceous glands and hair follicles and an inflammatory reaction. Five applications can produce this reaction and the degree of reaction is in proportion to the amount of carcinogen present. The long term reaction (six months or longer) consists of the development of cancer. We carried out experiments in which the smoke of 100 cigarettes was concentrated into a tar and was applied to the skin of mice. The dosage applied to each

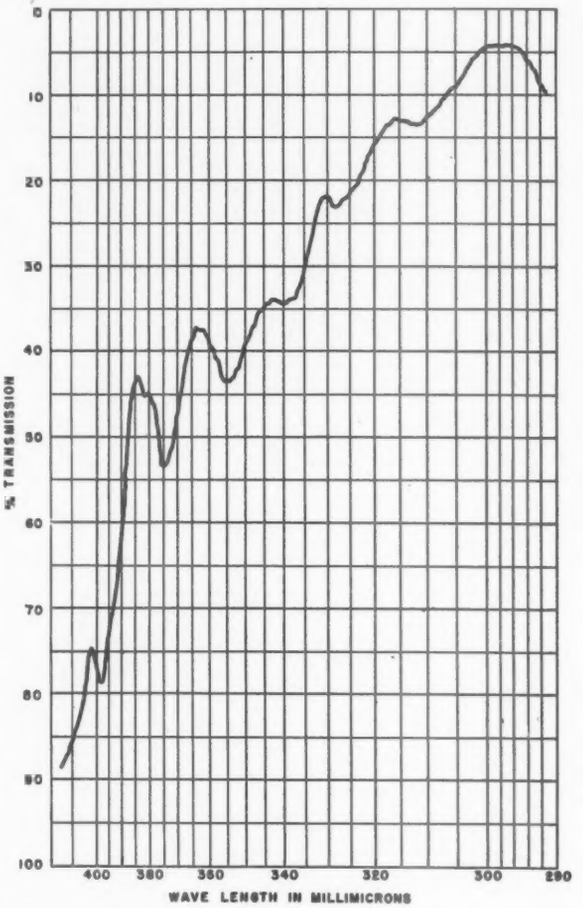
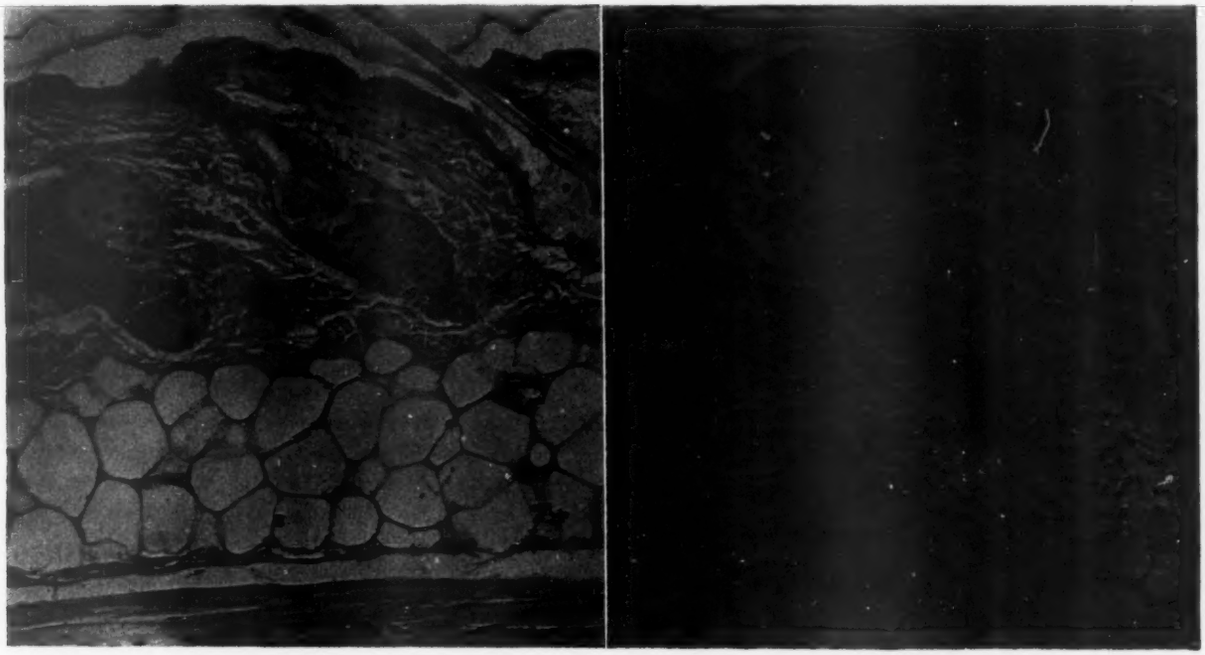


FIG. 3. Ultraviolet absorption spectrum of cigarette paper tar. The resemblance to the absorption spectrum of 3:4-benzpyrene is quite strong. The peaks are at 405, 385, 380, 365, 347 and 298 mμ as in Figure 1B.

mouse was 1 μg. per day as calculated on the amount of 3:4-benzpyrene estimated from the spectrographic analysis. This amount is approximately equal to the benzpyrene found in one cigarette. As a control, chemically pure 3:4-benzpyrene was diluted out in acetone to give approximately 1 μg. per application, and this solution was painted on the backs of the animals as in the case of the tars. Application of the cigarette tar (Fig. 4), and tar from cigarette paper smoke (Fig. 5) produced hyperplasia of epithelium and disappearance of sebaceous glands and hair follicles. Attempts were made to destroy 3:4-benzpyrene in the cigarette



4A 4B

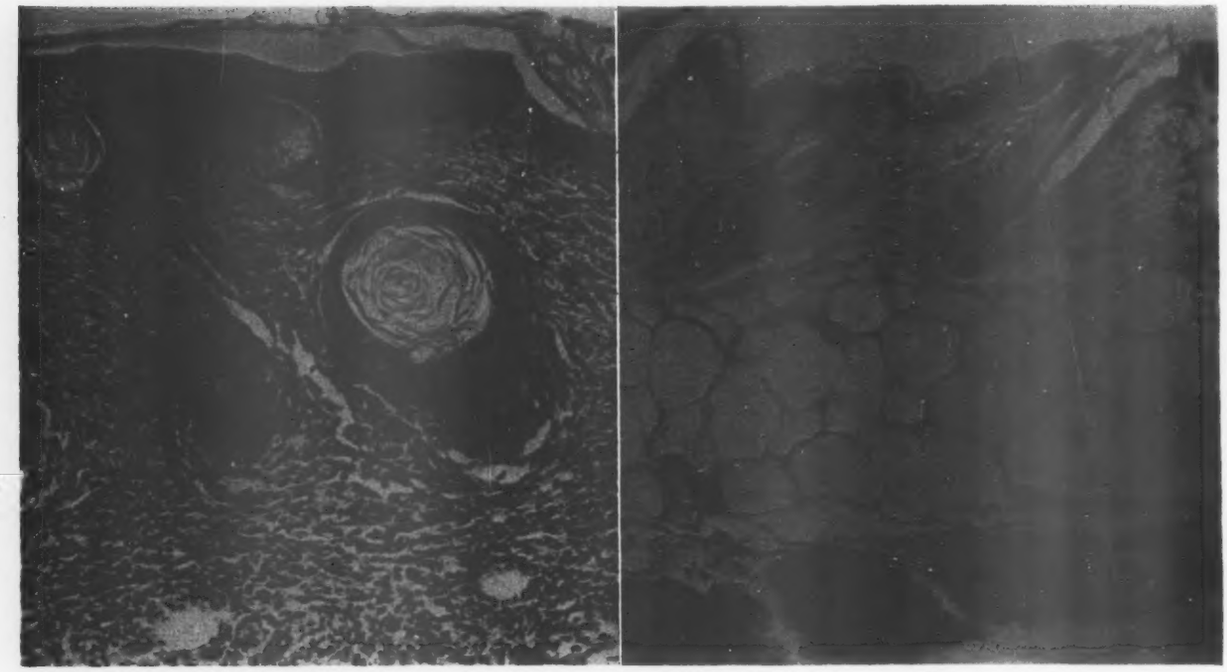
FIG. 4. Skin of mouse. A, normal. B, after topical application of 3:4-benzpyrene. Four applications were made of 1 μg. each. This is the amount in one cigarette. Note hyperkeratinization, edema, disappearance of sebaceous glands and cellular infiltration.

paper. This was accomplished by treating the paper with ammonium sulfamate. The reaction obtained by painting the skin of the mouse with such tar is shown in Figure 6A and B. The long term reaction was determined for cigarette paper smoke alone. Application of the tar of cigarette paper smoke alone produced cancer in some of our animals. The incidence of these reactions in our experiments cannot be given because of problems in handling the animals; therefore, percentages of cancer production cannot be given.

Cigarette Paper Tar and Tobacco Tar. Tars from the paper alone and the tobacco alone were tested separately. Spectrographic analysis indicated the presence of 3:4-benzpyrene in each of these tars. Tar from cigarette paper produced cancer when applied to the skin of mice and also when injected subcutaneously. The amount of 3:4-benzpyrene in the tar from the paper was approximately five times as much as the amount found in the tar from tobacco alone.

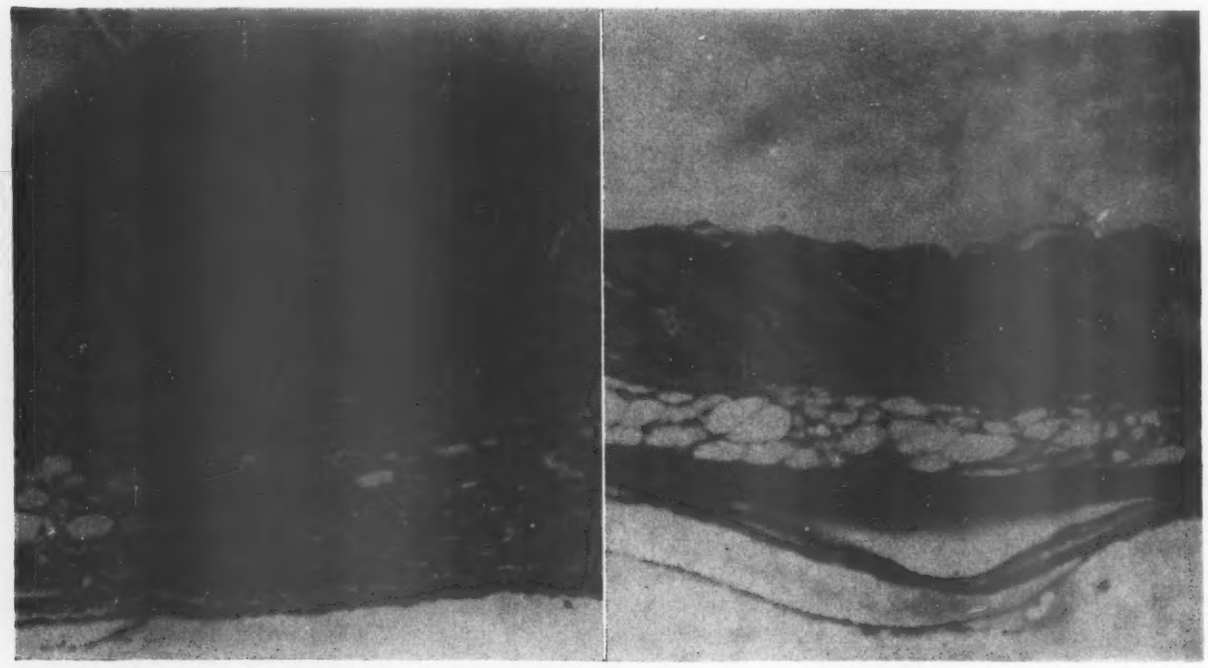
COMMENTS

Probably the first investigations into the tar of tobacco smoke and its relationship to cancer were carried out by Roffo [*8*] in 1936. He claimed to have identified 3:4-benzpyrene in tobacco tar and to have produced cancer by application of the tar to the ears of rabbits. The incidence of squamous epithelioma in the group of animals in which a thick liquid tar was used was 95 per cent. Sugiura [*9*] in 1940 repeated these experiments and found one carcinoma in 159 animals tested. Wynder, Graham and Croninger [*10*] in 1953 reported experiments on mice; in 44 per cent of eighty-one mice, cancer developed following the application of tar from cigarette smoke. In or about 1950, Rand and his associates began to carry out chemical analysis of the tar from cigarette smoke, and also the tar of the paper alone and the tar of tobacco alone. They found 3:4-benzpyrene in each of these tars. The tar from paper alone contained approximately three times as much as the tar from cigarettes. The tar from tobacco alone contained the least amount. In 1955 Cooper, Gilbert and Lindsey identified 3:4-benzpyrene in the tar of cigarette smoke, as did Lefemine, Grand and Ayre in 1954. These authors confirmed the work of Rand and referred to his unpublished work in their reports. In 1956 Latarjet and his co-workers from the Pasteur Institute reported an extensive study of these tars. They confirmed the presence of



5A 5B

FIG. 5. A, skin of mouse after application of tar of cigarette paper alone. Four applications were made and each was the equivalent of one cigarette. The reaction is similar to that in Figure 1B, but more severe. B, cigarette paper was treated with ammonium sulfamate before the tar was made. Four applications were made as in (A). The appearance is similar to that of normal skin.



6A 6B

FIG. 6. A, skin of mouse after four applications of tar of cigarettes; each application was equivalent to the tar of one cigarette. Note the thickening of epidermis, disappearance of hair follicles and sebaceous glands, severe edema and cellular infiltration. B, similar to (A) except the cigarette paper was treated with ammonium sulfamate before the tar was made. The appearance is similar to that of normal skin.

3:4-benzpyrene in the tars of both the cigarette and the paper. The amount was 1.2 μg. from the tobacco of 100 cigarettes and 3.0 μg. in the paper of 100 cigarettes. Treatment of the paper with ammonium sulfamate before the paper was smoked reduced the amount of 3:4-benzpyrene by about 98 per cent.

It may be of interest to note that Dr. Clarence Little, Medical Chairman of the Tobacco Industries Research Council and Director of the Jackson Memorial Laboratory, stated to the senior author in December, 1956, that his investigating committee accepted the presence of 3:4-benzpyrene in the tar of cigarette smoke, as reported herein, but he questioned whether the amount was significant in the production of cancer in humans. Sir Ernest Kennaway of the Royal Cancer Institute of England, who was the first to identify carcinogens in coal tar, stated at the Sloan Kettering Institute Meeting in May, 1956, that the amount of 3:4-benzpyrene in cigarettes was sufficient to produce cancer. Perhaps the informed chimney sweep could answer this question of dosage by saying that he, himself, should have changed his job before cancer developed.

CONCLUSIONS

1. Cigarette smoke contains the carcinogenic agent, 3:4-benzpyrene.

2. This fact was established by chemical analysis.

3. These laboratory data appear to substantiate the clinical experiences of the relationship between cigarette smoking and bronchogenic cancer. When a carcinogenic substance was painted on mice, the short term experiments produced similar reactions to that of 3:4-benzpyrene. Cigarette paper tars produced cancer.

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The Treatment of Operable Carcinoma of the Breast

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FROM 1894 until about 1941 the thinking regarding the surgical treatment of carcinoma of the breast had been crystallized into the concept that when operation was indicated radical mastectomy was the procedure to be performed. During the years immediately following 1941 and continuing with increased vigor to the present time, there have been noteworthy departures from the crystallized concept of the acceptance of radical mastectomy as the method of choice in the treatment of carcinoma of the breast. The departures have been in extremely opposite directions, with one group advocating the use of the more simple procedures while others have attempted to extend the scope of the standard radical procedure as outlined by Halsted in 1894.

These divergent trends have created a healthy situation in our thinking; they have created controversy and discussions and it is only by the creation of such discussions that important knowledge can be disseminated. Unfortunately, there has also occurred an increasing antagonism on the part of some of the medical profession to any procedure other than the use of the traditional radical mastectomy for the treatment of this disease. This attitude must certainly be for reasons other than the want of knowledge. An example of this attitude is quite evident in an article of Dr. D. Lyall published in *Surgery, Gynecology and Obstetrics* in September, 1956.

In the light of more recent investigation "their" attitude could be considered retrogressive and actually a negation of experience and of established surgical principles.

I have no quarrel with the individual who, by training, remains loyal to the traditional modalities of therapy, even though they be outmoded. However, I do feel strongly that such beliefs should not be imposed upon the profession.

Since even in the most skillful hands the conventional radical mastectomy may cause disfigurement, dysfunction and considerable psychic morbidity, it is very important to determine whether it is really necessary to employ it routinely or to employ it at all. To date there is no proof that the results of radical mastectomy are better than those of simple mastectomy. Pathologists may theorize on the rationale of eradicating cancer by extended surgery, but in the final analysis it is the survival of patients that counts. In fact, if one reviews the accumulated reports from many groups throughout this country and abroad, it will be noted that the results with the simpler procedures are statistically better than those with radical mastectomies.

Halsted himself, not long after his published report on the treatment of carcinoma of the breast, was most unhappy about the results. Soon afterward he attempted to extend his original procedure. His more aggressive attitude indicates that (1) the original procedure did not give him the desired results and (2) he hoped to obtain better results with the extended procedure. He, very wisely, soon afterward remained content, but not convinced, that radical mastectomy would have to remain his procedure of choice in the treatment of cancer of the breast at that time. His original procedure must have failed, in his opinion, or he would never have attempted any further extension of his surgery for this disease. I dare say if Halsted were alive today (and he would be well acquainted with the numerous unpredictable pathways for dissemination of this disease) he might advocate against the use of the procedure that bears his name. Perhaps he also might then be accused of heresy.

Today many surgeons remain content but are not convinced; they know that radical mastectomy is not the operation of choice for

cancer of the breast. Many open-minded surgeons have resorted to other means; some developed ideas for extension of the original procedure while others have followed the more conservative approach. The latter cannot be considered a regressive attitude because it is an honest attempt to improve results and survival rates and to offer an opportunity for treatment to a greater percentage of women with the disease. This holds particularly true in patients considered to be in stage III of the disease. In some clinics they would be considered inoperable and referred for radiotherapy alone. In McWhirter's series the five-year survival rate for the locally advanced cases (comparable to stage III) was 29 per cent for those treated with simple mastectomy and radiation. Bell, in reporting a group of fourteen cases (stage III) in which simple mastectomy and radiation was the treatment applied, revealed that 21.4 per cent of the patients were living and well five years later, as compared with a 16.6 per cent five-year survival for patients treated by radical operation alone. He expressed the opinion that radiation was responsible for the better results in the first group and stated: "If a greater number of cases were represented, this might point more toward confirmation of McWhirter's ideas."

In order to follow this thesis to a logical conclusion, a brief review of the lymphatic spread and manner of dissemination of carcinoma of the breast is in order.

The lymphatic drainage of the breast is rich and replete with plexuses, so that the direction of spread of malignant cells through these channels is understandably unpredictable and fortuitous. Drainage is generally toward the skin surface where a subcutaneous plexus of lymphatic vessels permits the cells to be carried in almost any direction. The cells may migrate medially to the internal mammary nodes or laterally to the axillary nodes. They may even migrate to the inguinal nodes. These migrations may require months or years. Periods of quiescence are followed by fresh migrations. Skin nodules are commonly observed in the vicinity of the lesion in advanced cases, or they may appear years after mastectomy. These so-called recurrences simply indicate macroscopic extension of disease that was present but not removed at the time of operation.

The lymphatic trunks that converge toward regional lymph nodes provide another method for spread of cancer of the breast. The spread occurs laterally towards the axilla, superiorly toward the supraclavicular nodes, medially toward the internal mammary group and mediastinal nodes, and inferiorly through the linea alba into the abdomen. The exhaustive

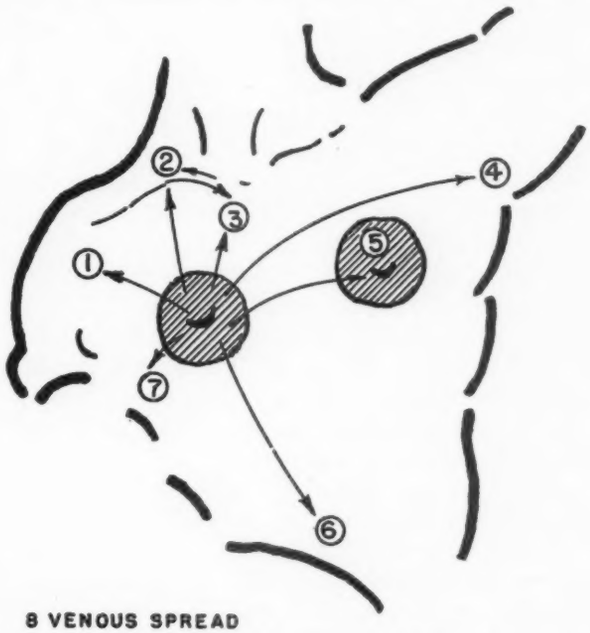

FIG. 1. Routes of lymphatic spread. (1) Sixty per cent of operable cases have positive axillary nodes. (2) Thirty-three per cent of these have supraclavicular nodes involved. (3) Forty-six per cent of the operable cases with axillary nodes have internal mammary node involvement. (4) Spread to opposite axilla. (5) Spread to opposite breast. (6) Spread into abdomen. (7) Spread directly into chest. (8) Venous spread.

studies of many qualified investigators have revealed that these paths of dissemination are never predictable. The lesion can spread to the supraclavicular nodes without involving the axilla; it may spread directly into the internal mammary group and mediastinum without involving the axilla; it could extend directly into the chest, over to the other breast and axilla, into the abdomen and even down into the inguinal nodes. (Fig. 1.)

One cannot consider the groups of nodes about the axilla, neck, mediastinum and internal mammary region as completely unrelated and independent. Radiographic examination of calcified tuberculous nodes may very clearly demonstrate the continuity of the nodes in the supraclavicular and axillary regions. In cancer of the thyroid the presence of nodes in the lower portion of the neck is commonly asso-

ciated with involvement of the axillary nodes. Here the disease spreads downward, and if it can spread in that direction it is fair to assume that it can also spread in an upward direction. It is, therefore, easily understandable that once cancer has spread to the axilla, it can readily extend throughout the entire chain and so involve the nodes which happen to be above the clavicle.

The continuity of the posterior cervical chain of nodes and the axillary group has been demonstrated in cases of cancer of the nasopharynx. This same posterior chain is not uncommonly involved in cancer of the breast according to McWhirter.

The internal mammary chain of nodes, which is considered very important by some and only a secondary group to be invaded by others, bears a similar relationship with the supraclavicular nodes as the axillary group. Wangensteen has shown that 60 per cent of either the supraclavicular or internal mammary group were involved when the axillary group was positive.

It can, therefore, be clearly appreciated that unless all these potential areas for dissemination of the disease are eradicated, the procedure is doomed to failure. Wangensteen attempted to do this but soon realized the futility and discontinued such an extensive procedure.

Proliferation along lymph channels is not the only method of dissemination. What is even more treacherous is the spread of the disease by venous channels. This is much more common than we have realized. In 59 per cent of a series of 107 cases of operable cancers of the breast, lung, stomach and colon, Engel of Stockholm, Sweden, found cancer cells free in the blood of the veins that drained the cancer areas. Of these, 35 per cent of grade 2 cancers had cells in the blood, 78 per cent of grade 3 and 100 per cent of grade 4. Tumor cells also migrate, and like white blood cells they work their way through the walls of capillaries and thereby spread by way of the blood stream. It has been stated that perhaps 10 to 20 per cent of cases of cancer of the breast have dissemination through the blood stream. This method of dissemination can well explain the all too frequent case of a patient with a small lesion, no regional adenopathy and with distant metastases.

The principle upon which radical mastectomy was originally performed was that cancer of the breast generally would spread in an orderly fashion and in one direction, i.e., into the axillary nodes. It is obvious from the rather brief description of the lymphatic spread of this disease that this is not true in most of the patients; by the time the patient presents herself for therapy many of the other nodes are involved. Even the ultraradical procedures do not encompass all these avenues of spread in their surgical maneuvers. Removal of the breast, axillary nodes, supraclavicular nodes, internal mammary nodes and even part of the chest wall does not assure one of a cure. Halsted appreciated this soon after he became interested in this field of surgery.

The location of the lesion in the breast and the prediction of the involvement of a particular group of nodes is another point for emphasis in the treatment of operable carcinoma of the breast. Handley and Thackey have indicated that the internal mammary group of nodes is involved in a high percentage of cases of cancer of the breast. Other investigators have proposed that the internal mammary group of nodes is more likely to be involved with a lesion in the medial quadrant of the breast, and they have devised ultraradical procedures to remove all involved tissue. On the other hand, Hutchinson found no correlation between the location of the lesion in the breast and the incidence of mammary node involvement in his study of eighty-one consecutive cases.

Heroic attempts have been made by many honest surgeons both here and abroad to extend the scope and magnitude of radical mastectomy. The reports of both Wangensteen and Dahl-Iversen have not been encouraging, and it will be most interesting to note five-year survival rates of others when they are made available.

The ultraradical procedures that have been attempted have been most valuable only in revealing added knowledge about the lymphatic spread of cancer of the breast. The results and knowledge obtained have simply fortified the belief that both radical mastectomy and the ultraradical procedures attempted are indeed not the procedures of choice for cancer of the breast because of the unpredictability of the lymphatic spread of the cancer from any quadrant of the breast.

Haagensen triple biopsy has been a most noteworthy contribution to the profession. It not only has given us additional valuable data about the dissemination of the disease but also

is an indication of a trend to perform less radical mastectomies on patients who only recently were considered suitable candidates for the classic Halsted procedure.

The five-year survival rates of patients treated by the simpler methods with or without radiation have become increasingly encouraging, Williams, Murley and Curwen concluded that with or without radiation, simple mastectomy gave better results than radical mastectomy at St. Bartholomew's Hospital. Meyer and Smith, in their report on a non-selected group of cases, had an 8 per cent higher survival rate with the simpler procedures, as compared with those patients who had radical mastectomies. Deaton and Bradshaw, Orr, Small and Dutton, Garland and Byrd and Conerly, have all come to similar conclusions. Finally Deaton, in a survey of the world literature, reported that the survival rate following simple mastectomy was 5 per cent higher than that following radical mastectomy.

The present controversy in our thinking about cancer of the breast was precipitated by McWhirter in Edinburgh, Scotland, who subjected a population group of more than one million people to a careful clinical experiment. All cases of cancer of the breast that occurred in this population group were included, regardless of how they were treated, or whether they received no treatment at all. His survival rates for patients receiving simple mastectomy and radiation were 10 per cent better than the patients treated with radical mastectomy. His latest supplementary report, including ten-year survival, is even more encouraging.

Ackerman, in reviewing McWhirter's work, did not agree with McWhirter's conclusions but had little criticism of the basis for the diagnosis or of the completeness of the follow-up. In fact, most of Ackerman's conclusions were not particularly germane to McWhirter's major thesis. In a discussion of the same report in this city he spoke freely of "happy cells" found in lymph nodes that were supposedly sterilized by radiotherapy. This may be true. However, it is also true that many of these cells were incarcerated and rendered impotent for at least an extended period of time. What was not mentioned was the "happier cells" that are left behind, when performing radical mastectomy, in other nodes involved when the cancer is disseminated, i.e., supraclavicular nodes, internal mammary chain of nodes, mediastinal nodes, contralateral axillary nodes and sometimes even in inguinal nodes. These instances constitute a large percentage of women who apply for treatment.

The poor results attributed to radiotherapy at the time of study (1941 to 1947) is understandable. It was during the war years and the equipment and personnel were not satisfactory. These unfortunate complications are avoidable today with the better understanding of radiation therapy and the protracted method of treatment suggested by McWhirter and others.

The recurrence rate in McWhirter's series cannot be considered too bad when one considers that some clinics report a rate as high as 82 per cent and others a rate as low as 2.5 per cent. Furthermore, the recurrences appeared mostly outside his field of treatment; this, of course, is now avoidable with the more adequate and higher standard of radiotherapy. The appearance of local recurrence does not necessarily mean that the modality of therapy used is at fault; it simply indicates a recrudescence or perhaps the continued progress of the natural course of the disease.

It is unfortunate that all patients treated in a hospital could not be compelled to return to them for follow-up study. It is quite possible that they may not get the complete and true results of postoperative radical mastectomies because many patients refuse to return to that institution. For many years at one of the municipal hospitals, I saw the end results of many cases of radical mastectomy performed elsewhere. The complications ranged from frozen shoulders and injury to the brachial plexus to lymphangiosarcoma following lymphedema of the arm. To avoid such complications certainly cannot be considered retrogressive.

Adequate surgery for cancer is not based on picking out lymph nodes. The areas of fascial plane permeation in lymphatics comprise a basic consideration and one should attempt to maintain the integrity of the cancer field. This has been the purpose for the extension of operations for the treatment and cure of this disease. With the most honest and aggressive type of surgery this cannot possibly be accomplished in treating cancer of the breast if one bears in mind the anatomy of the lymphatics and the pattern of lymphatic spread. Radical mastectomy has to be considered as discontinuous a procedure as simple mastectomy and, in fact,

more harmful for it opens up more channels for dissemination. It is only with adequate radiation therapy at this time that we can hope to extend suitable treatment to areas inaccessible by any type of surgery.

I am in complete accord with the assumption that the five-year survival rate is unreliable, for we are all familiar with the fact that a recrudescence of the neoplastic processes may develop in many patients most any time after they have been considered five-year clinical arrests. This is due to uncontrollable factors such as host resistance, and reactivation of the virulence of the offending cells, for which we have no defense either surgically, radiologically or, as yet, chemically. It is these conditions, about which we know so little, that have caused men with open minds to reconsider their form of surgical therapy.

As for radiotherapy, I believe most men today agree that adequate cancerocidal doses are prohibitive to the host and that the best that can be hoped for is to incarcerate potentially malignant cells and at least make them inactive for a time, and hope that the so-called host resistance might be increased to the point where these cells could be maintained in an impotent state for an extended period of time.

Postradiation complications were indeed a serious factor in the past. Poor equipment and incompetent help were the reason for some of McWhirter's bad results in the immediate postwar period. However, with the higher standard of therapy applied today and the more adequate distribution of the dosage over a protracted period of time, the postradiation complications have become a thing of the past.

In closing, I would like to comment on the policy adopted by Dr. Lyall for the treatment of operable carcinoma of the breast.

First, he states that radical mastectomy has to be performed early. What does he mean by early? Does he mean immediately after the patient applies for treatment or does he mean early in the course of the disease? We are all familiar with the patient who presents a small, apparently early lesion, with dissemination of disease to the extent that radical mastectomy would be most inadequate, to say the least. Then again, some clinics have reported that as many as 80 per cent of women who apply for treatment already have involvement of axillary nodes. If this is true, and 60 per cent of them have involvement of either supraclavicular or mediastinal nodes, it can be seen that very few patients can be considered candidates for early operation.

Second, he says that the cancer field must be kept inviolate. It is most difficult to comprehend how one can hope to accomplish this with the knowledge we have about the pathways and methods of dissemination of cancer of the breast. How can one possibly avoid cutting across lymphatic pathways in performing radical mastectomy? As Handley Sr. stated, "Unfortunately this microscopic growing edge of the carcinoma is not clinically recognizable, and the surgeon cannot determine for each case as it comes before him how far the circle of fascial permeation has extended."

Third, Lyall stated that the upper outer quadrant is the most frequent site of cancer and that the axilla is the site of primary metastasis in well over one-half the cases.

This is usually true, but we must bear in mind that there is no correlation between the location of the lesion and the pattern of dissemination of the disease. Therefore, it can be seen that radical mastectomy is certainly not going to accomplish the desired effect, i.e., to remove *en bloc* the original lesion, the breast and all the tissue in continuity to the farthest limit of its spread. Certainly a large percentage of these patients will have nodes in the supraclavicular region and elsewhere. Classic radical mastectomy does not include these areas, and they will have to be treated by radiotherapy.

Lyall's fourth point concerns his recommendation of radiotherapy. If he believes radical mastectomy is the only procedure of choice, why should he depend on radiotherapy for any assistance? Certainly he must know that the operation is inadequate for many patients and that he must rely on other modalities of therapy to give his patients that which they came for, namely, a better chance to live longer.

It is quite obvious from what I have said that it is my feeling, at this time, that surgery is the best modality of therapy for operable cancer of the breast and that simple mastectomy with postoperative radiation is to be preferred to radical mastectomy. The removal of accessible axillary nodes could be done without additional morbidity. This would be done for prognosis rather than for further complete eradication of disease.

The evaluation of any method of treatment

for carcinoma of the breast is confused by innumerable variable factors. I am conscious that my enumerations of objections to radical mastectomy may be lacking convincing completion, but the catalogue of errors is a lengthy one and to mention all and moralize on each would be tedious and wearisome. All I hope to accomplish is to arouse and fertilize the imaginations of those who care to maintain an open mind, and should anything that has been said bear the appearance of arrogance, may I confess that it has arisen from sorrowful contemplation of the surgical errors which I myself have committed in the treatment of this disease.

We recommend:

A Textbook of Surgical Pathology. By Charles F. W. Illingworth, C.B.E., M.D., CH.M., F.R.C.S. and Bruce M. Dick, M.B., F.R.C.S. Seventh edition, 730 pages, 322 illustrations, with references at chapter endings and an index. Boston, 1957. Little, Brown & Co. *Price* $14.00.

Injuries to the Hand. By Ronald Furlong, F.R.C.S. 215 pages, with 99 illustrations, and an index. Boston, 1957. Little, Brown & Co. *Price* $9.00. (A quick reference and working manual on injuries to the hand. A concise monograph, without burdensome detail.)

Halsted of Johns Hopkins. The Man and His Men. By Samuel James Crowe, M.D., Professor Emeritus of Laryngology and Otology, The Johns Hopkins University, Baltimore, Maryland. 248 pages, illustrated. Springfield, Ill., 1957. Charles C Thomas. *Price* $5.00. (An intimate picture of the spirit of the Halsted era; the story of Halsted's inspiration to those who worked with him and the story of the young men with whom Halsted surrounded himself. Delightful.)

The Problem of Carcinoma of the Tongue in India

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OUR observations, together with those of others engaged in the study of cancer in this country, indicate a fairly high proportion of oral and pharyngeal carcinomas. Judging from the records of patients admitted to the Tata Memorial Hospital in Bombay, it appears that the oral, oropharyngeal and hypopharyngeal carcinomas together make up 45 per cent of all carcinomas. This abnormally high incidence has created a great interest and systematic investigations are in progress with a view to probe into its etiology. Observers [1] from Western countries report the incidence of this entire group to be less than 10 per cent of all carcinomas.

Of special interest to us is the carcinoma of the tongue which presents many unusual features. During the fifteen-year period 1941 through 1955 4,200 cases of carcinoma of the tongue have been recorded in the outpatient clinic, but for the purpose of this study we have considered only 700 unselected cases with a definite histologic evidence of malignancy which were accepted for treatment during the three years 1948 through 1950. This period has been selected because in previous years, during the war, the working of our radium plant was unsatisfactory and the facilities for radiotherapy were inadequate. For very good reasons, the customary division of the tongue into an anterior and a posterior portion seems important. Carcinomas which arise from these two areas differ, to some extent, in their histology and mode of spread; consequently the therapy varies and so does the prognosis. We prefer to include the malignant epithelial growths of the anterior two-thirds of the tongue in the group of oral carcinomas which, besides the tongue, includes the lips, the floor of the mouth, the alveoli, the buccal mucosa and the hard palate. It is important to note that as a group the aforementioned carcinomas present certain common features: they are mainly slow-growing squamous carcinomas, frequently composed of well differentiated cells. The metastases to the cervical lymph nodes occur late in the course of the disease and remain localized to one side of the neck unless the primary disease is in an advanced stage or has crossed the midline when bilateral cervical metastases may be observed. It is best to include carcinoma of the posterior portion of the tongue in the group of oropharyngeal carcinomas. Malignant epithelial tumors in this site are often composed of undifferentiated cells and are rapid in progress. Early involvement of the cervical lymph nodes is a common feature and the spread is mainly to the superior group of the deep cervical chain. Bilateral cervical extension of the disease is not infrequent. Lymphoepithelioma, another variety of malignancy, is often encountered in this site.

In our series there were 520 cases of carcinoma at the base of the tongue and only in 180 was the disease located in its anterior part. Thus the base of the tongue was affected three times more often than the anterior portion, an observation reported by Khanolkar [6]. Martin et al. [8], Cade [5] and others write of a much higher incidence of the disease in the anterior part of the tongue. Carcinoma of the tongue was more frequent in men (80 per cent) in our series. The highest incidence of this disease was noted in the age group of forty to forty-five years. Ahlbom of Sweden records an incidence of almost 40 per cent in females and he attributes this to the association of Plummer-Vinson syndrome.

Leukoplakia coexisted with carcinoma in 32 per cent of our cases. We had ten patients

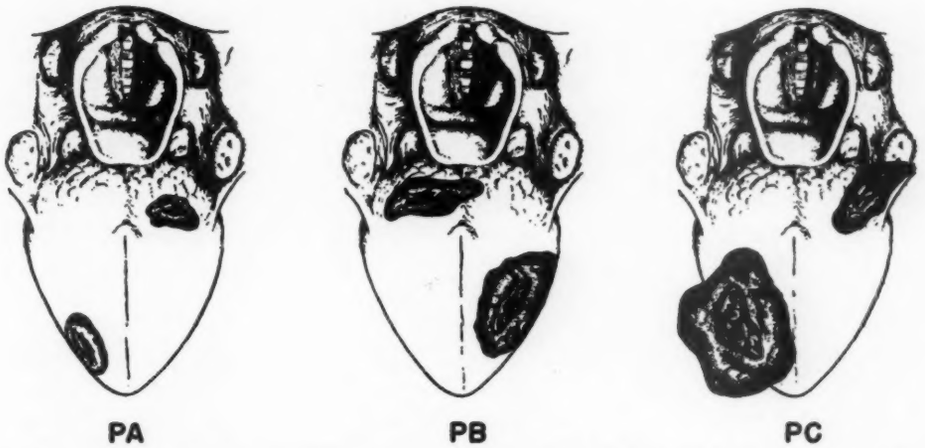

FIG. 1. Primary growth (P). PA, primary growth less than 1½ cm. in diameter, strictly localized to the tongue; early and operable stage. PB, primary growth less than 3 cm. in diameter, still localized to the tongue; moderately advanced yet operable stage. PC, primary growth more than 3 cm. in diameter; disease extends on to the adjacent structures; advanced and inoperable stage.

in whom there was an evidence of more than one carcinoma in the oral cavity and in all of them the disease appeared to develop from isolated patches of leukoplakia.

Syphilis as a predisposing factor in this form of disease has been overemphasized by Levin et al. [7] and Martin et al. [8]. Evidence of a positive serologic test for syphilis was present in only 10 per cent of our series.

In a fair number of our cases of carcinoma of the oral cavity we noted a dark patchy pigmentation of the oral mucous membrane. The relationship between this pigmentation and the carcinoma is being studied.

Poor oral hygiene and dental caries were associated with carcinoma of the tongue in almost 70 per cent of our cases.

In the State of Bombay, the Hindu community is by far the largest. It consists of two sections: members of one sect come from Gujerat and are called Gujeratis while those who come from Deccan are known as Deccanis. The distribution of the disease in these two sects of Hindus is markedly different and is a point of interest. Carcinoma of the posterior third of the tongue was seen most frequently in the male members of the Gujerati sect of Hindus who had a history of excessive smoking of a locally prepared cigarette called the "biddi." Sanghvi et al. [9] believe that this may be an etiologic factor. At the base of the tongue the carcinoma often appeared as a vascular cauliflower type of growth, situated on one side of the midline. Another site was the glossopharyngeal sulcus where it assumed the form of an indurated fissure. Sixty per cent of cases of carcinoma of the base of the tongue had palpable metastatic lymph nodes in the neck and 50 per cent of these were bilateral. The superior group of the deep cervical chain of lymph nodes was frequently affected and gross disease in this site invariably proved fatal.

The anterior portion of the tongue and particularly its lateral borders were seen to be affected more often in the Deccani sect of Hindus in whom the habit of chewing betel nut with slaked lime and tobacco was most prevalent. The female members of this sect also shared this habit and it was not surprising to find a correspondingly higher incidence of this disease in them. Evidence of malnutrition and avitaminosis was also noted in a fair proportion of these females.

Confronted with a large number of cases of carcinoma of the tongue and other oral and oropharyngeal carcinomas, we felt the need of a uniform clinical classification indicating the stage of the disease. For this purpose we adopted the following procedure: In each case, accurate information regarding the size and extent of the primary growth together with the site and size of the cervical metastases was obtained by utilizing different sets of symbols. The size and extent of the primary growth (P) is indicated by PA or PB or PC as shown in Figure 1. On each side of the neck are situated seven important groups of lymph nodes into

which metastases could occur, as indicated in Figure 2. It is very important to know the site of the disease in the neck from the point of view of therapy and ultimate prognosis because disease in the anterior groups of lymph nodes can often be efficiently eradicated by surgery, but when the posterior and superior groups of lymph nodes are involved the prognosis is poor regardless of the line of therapy. The size of the cervical metastases (M) is indicated by Ma or Mb or Mc as shown in Figure 3. Finally, a combination of these symbols gives a precise clinical impression of the primary growth and its metastases. For instance, when the primary growth is very small and there are no palpable nodes in the neck, this condition is expressed as PA − M. When the primary disease is moderately advanced and there are early metastatic nodes in the submaxillary region, this condition is expressed as PB + 2Ma. When metastatic nodes are present on both sides of the neck, they are expressed as right and left.

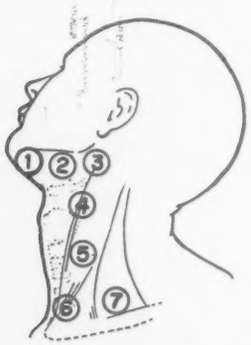

FIG. 2. (1) Submental group of lymph nodes. (2) Submaxillary group of lymph nodes. (3) Superior group of the deep cervical chain of lymph nodes. (4) Jugulodigastric group of lymph nodes. (5) Mid-cervical group of lymph nodes. (6) Anterior supraclavicular group of lymph nodes. (7) Posterior supraclavicular group of lymph nodes.

The disease is said to be in Clinical Stage I when the primary growth is localized to the tongue and is less than 3 cm. in its longest diameter but there are no palpable metastatic nodes in the neck. Such a condition is expressed in symbols as PA or PB − M.

The disease is in Clinical Stage II when the primary growth is still localized to the tongue and is less than 3 cm. in its longest diameter, but there are small or moderate sized lymph node metastases on one side of the neck. This stage is expressed in symbols as PA or PB + 1, 2, 3, 4, 5, 6 or 7 Ma or Mb.

The disease is in Clinical Stage III when the primary growth and/or the metastases are advanced. Patients with bilateral cervical metastases or metastases in distant organs are also grouped in this stage. The following is the manner in which the disease is expressed in symbols:

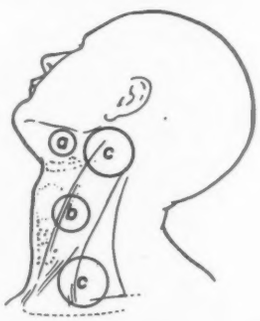

FIG. 3. Size and extent of metastases (M). (*Ma*) Metastatic mass less than 1½ cm. in diameter; metastatic lymph nodes mobile; early and operable stage. (*Mb*) Metastatic mass less than 3 cm. in diameter; metastatic lymph nodes moderately enlarged and not fixed; moderately advanced yet operable stage. (*Mc*) Metastatic mass more than 3 cm. in diameter; metastatic lymph nodes hard and fixed; advanced and inoperable stage.

PA, PB or PC + 1, 2, 3, 4, 5, 6 or 7 Mc
PC + 1, 2, 3, 4, 5, 6 or 7 Ma or Mb
PC − M (rare)

With a little practice we have been able to classify almost all of our cases of oral carcinoma in this manner. Following the aforementioned clinical classification only 10 per cent of our 700 cases of carcinoma of the tongue were in Stage I; 30 per cent were in Stage II; and the remainder were in Stage III.

The importance of this classification is obvious. It enables observers to collect uniform clinical data, and only when the clinical material is thus well classified can the superiority of a particular mode of therapy be correctly evaluated.

From a perusal of recent literature it is evident that there are two sharply defined opinions on the treatment of carcinoma of the tongue. In some centers where radiotherapy was used before, there is a definite shift to surgery. By way of contrast, reports from some of the best radiotherapy centers [*2–5,10,11*] give encouraging results and express a hope of

further improvement with the development of newer technics and a wider use of radioactive agents now produced artificially. We believe that a routine use of radiotherapy or surgery cannot be adopted in all cases, but that there are definite indications for either form of treatment.

At the Tata Memorial Hospital we have an opportunity to observe a large number of patients with carcinoma of the base of the tongue, many of whom have extension of the disease to the cervical lymph nodes. We have treated these patients exclusively with radiotherapy and in our present series of 520 cases, including all stages of disease, the five-year survival rate is 25 per cent. We are convinced that this rate could be improved if by some measure more patients in the early stages of the disease reported for treatment. In other centers a few surgeons have successfully employed surgery in the treatment of early cases of carcinoma of the base of the tongue. Howver, such cases are few and radiotherapy would have yielded the same result. The value of surgery as a mode of therapy for a moderately advanced carcinoma of the base of the tongue is very doubtful.

With regard to the treatment of an early case of carcinoma of the anterior portion of the tongue which is strictly limited to the organ, the position of surgery versus radiotherapy is similar. The chances of cure are equal with either form of treatment. When the disease has progressed and has encroached upon the adjacent structures it poses a problem and calls for a critical survey of the line of treatment to be adopted.

An analysis of our treated cases of cancer of the anterior portion of the tongue has revealed a few significant facts which we propose to state. Also, the pros and cons of radiotherapy and surgery, in retrospect, will be discussed.

Of a total of 180 cases, we treated sixty-two exclusively by surgery. Hemiglossectomy was performed followed later in many by radical neck dissection on the same side. The five-year survival rate was 32 per cent. The remaining 118 cases were treated either with radiotherapy alone or by a combination of radiotherapy and surgery. In these the five-year survival rate was only 20 per cent. No definite conclusions can be drawn from these results because of the dissimilarity of cases in the two groups. The survival rate is better in the first group because there was a tendency to accept early cases for surgery and refer more advanced ones for radiotherapy.

In some of our unsuccessful cases which were treated exclusively by radiotherapy we observed the following unhappy sequence of events. While waiting for the primary disease to regress under radiotherapy, the cervical metastases, which were barely palpable in the beginning, became enlarged and fixed to the mandible. In others, fresh cervical metastases appeared, and at the completion of the treatment of the primary disease the nodes in the neck were found to be hard and fixed to the surrounding structures so that the idea of subsequent radial neck dissection had to be abandoned.

We treat such cases to-day in a different manner. At the earliest sign of deterioration in the condition of the metastases, the radiotherapy is discontinued and radical surgery is performed with removal of the primary growth and the matastatic nodes in the neck in one stage (*en bloc*). The results of surgery in this type of case have so far been quite encouraging.

We also observed disappointing results in those patients who had involvement of the floor of the mouth with an extension of the disease toward the alveolus but not actually invading the mandible. In spite of well planned radiotherapy, cancer remained uncontrolled and in many instances the disease and radionecrosis lurked side by side in the tissues of the neck, giving rise to edema and severe pain. Invasion of the floor of the mouth by the disease we now consider an indication for primary surgery, and in recent years this mode of therapy has been reported to yield much better results.

Primary surgery was not successful in cases in which the disease had extended into the pterygoid space and in which several large metastatic lymph nodes were encountered in the region deep to the posterior belly of the digastric muscle. Carcinoma recurred in these patients too soon after surgery. We now resort to primary radiation therapy for this type of case and observe that the disease remains controlled and the patient comfortable for a much longer period of time.

SUMMARY

The following few important facts have emerged from a detailed clinical study of 700 cases of carcinoma of the tongue:

1. Carcinoma of the tongue is a fairly common disease in India. It was observed in 4,200 cases of a total of 30,000 carcinomas recorded at the Tata Memorial Hospital.

2. The base of the tongue was affected three times more often than its anterior part.

3. The distribution of the disease was different in the two sects of Hindus: in the Gujeratis the disease was more often at the base of the tongue while in the Deccanis it was frequently in the anterior region. There is sufficient evidence to show that the incidence of carcinoma of the tongue and of the buccal mucosa is definitely higher in those persons who chew betel nut with slaked lime and tobacco.

4. A uniform clinical classification has been adopted for the purpose of staging the disease.

5. The pros and cons of radiotherapy and surgery have been discussed, with special reference to the 700 treated cases of carcinoma of the tongue.

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Mediastinal Teratoma Simulating Adenomatous Goiter

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WITH the possible exception of the lipoma, teratoid tumors are probably the most common tumors found in the anterior mediastinum. Actually it is not to be inferred that this classification of tumors is frequently encountered, for extensive review of the literature brings to light less than 400 recorded cases. According to Goorwitch and Sokol [*1*], 362 cases were reported by 1951 in a survey which included European as well as American literature.

HISTORY

The first teratoid tumor of the mediastinum (dermoid cyst) was reported by J. A. Gordon in an address to the Medico-Chirurgical Society of London in November, 1823. His address was later published in the 1827 edition of the Society's Proceedings. He reported that the tumor, located in the anterior mediastinum, contained sebaceous material, hair, a bone which bore an extraordinary resemblance to the maxilla, and seven teeth.

The next mention of such a tumor was by Spath in 1836. He noted that grossly the growth contained cartilage, fibrous and fatty tissue, and bone. There was no available microscopic study. Three years later Muny published a concise clinical record of such a cyst in the anterior mediastinum of a twenty-eight year old woman.

There have been occasional reports of this type of tumor from this point on, but it was not until 1869 that Nobiling clearly established teratoid tumor as a clinical entity by correctly diagnosing it in a case in which the chief feature of the patient's history was expectoration of hair.

In 1916 Hertzler collected seventy-two cases from the medical literature and added one of his own. By 1928 Kerr and Warfield increased the number of reported cases to 138. Hedblom [*2*] compiled 185 and added six of his own in 1933. In 1936 Andrus and Heuer [*3*] reported 217 cases, and in 1944 Rusby [*4*], in an excellent review of the literature, reported 252. Goorwitch and Sokol's [*1*] report of 362 cases is the most recent.

PATHOLOGY

The statement that the origin of the tumor preceded the birth of the individual is probably true, for the present literature indicates that the teratoid tumor is a result of an embryologic defect. Although the tumor is present at birth, the majority are dormant until adolescence or early adult life. They are most commonly seen clinically in the third decade. They must not be discounted, however, from a differential diagnosis simply on the basis of age, for Wheatley reports a mediastinal teratoma removed from a seven month old child. The tumor apparently has no predilection for sex or for the side of the chest affected.

Hedblom [*2*] divides teratoid tumors arbitrarily into three types, depending upon their tissue of origin. They are: (1) epidermoid type, derived completely from the ectoderm; (2) dermoid type, derived from entoderm and mesoderm; and (3) teratoma, derived from all three germ layers.

He emphasizes that in many cases the distinction between the types is difficult or impossible to make, and that in reality the majority of the tumors are teratomas incorrectly labeled as dermoids.

The teratoid tumors are divided further into two groups, solid and cystic, with the latter the predominant form. The cysts are usually smooth, glistening and enclosed in a fibrous capsule, but may occasionally be ragged. The cyst may be attached to associated mediastinal

structures or to the sternum by a stalk of variable length and thickness that must be divided if surgical treatment is to be successful and recurrence prevented. Because of the presence of this stalk, a tag of tumor tissue may have to be left behind, but there is no mention of recurrence of the condition or of malignant degeneration of tissue remaining in this fashion. Also, the cyst itself may be adherent to surrounding mediastinal structures. These adhesions may be so thin that they afford the surgeon no great inconvenience, or they may be so strong and heavy that complete excision is rendered impossible because of the danger to surrounding vital structures. The inner lining of the cyst may be of two forms: first, it may bear numerous papillomatous projections; or second, the wall may be smooth and contain only a single hard ridge running the length of the growth. From the projections or from the ridge spring the hairs, the presence of which afford an immediate diagnosis of the gross lesion. The cysts are lined with stratified squamous, cuboidal or columnar epithelium. Sebaceous material and hairs are characteristically found in the cavity, but clear yellowish or brown fluid may also be found. In the solid parts of the tumor, a wide variation of tissue may be found. Nylander et al. [*6*] list the tissues which they were able to differentiate microscopically in their thorough study of a large series of cases. They found nerve tissue, skin, connective tissue, fat, blood and lymph vessels, lymphatic tissue, smooth and striated muscle fibers, cartilage, bone, intestine, respiratory structures, pancreas, liver and even placenta. In no case was a structure well enough differentiated to be recognizable grossly, but there have been reports in the literature of fully formed bones and teeth.

The completely solid teratoma is rare, and shows a greater tendency toward malignant change than does the dermoid. The tissues within them may appear to be well differentiated and adult, but the potential malignancy must not be ignored. When found in the younger age groups, the tumor is usually malignant from the start. Malignancy in the adult is generally accepted as the result of the degeneration of a previously benign part, usually epithelial in nature. About 12 per cent degenerate to malignancy.

The most common malignant degenerations are either carcinomatous or sarcomatous, or chorioepitheliomatous. Metastases occur in the lungs and the mediastinal lymph nodes. No cures have resulted in those tumors which have undergone malignant changes. The fact that there may be a chorioepitheliomatous element affords a diagnostic tool, for the Aschheim-Zondek test is only positive in the male in cases of testicular teratoma, extragenital teratoma and chorioepithelioma.

The tumor may undergo secondary infection in two ways. First, a fistula may be formed between the cyst cavity and the bronchus. This fistulous tract may lead to direct infection of the cyst from the outside. Second, the cyst may be infected through the blood and lymph streams supplying the tumor tissue.

The tumor grows to an extremely large size. Fox and Hospers [*7*] report a solid teratoma which weighed 9 kg. Nandrot [*8*] aspirated 3 kg. of sebaceous material and later excised a tumor, which then weighed 8 kg., making a total of 11 kg. This mediastinal tumor is the largest on record.

PATHOGENESIS

Although it is generally agreed that the teratoid tumor is the result of an embryologic defect, the precise etiology is still a matter of conjecture. There have been several theories advanced, but it is not the purpose of this paper to review all of them and weigh their relative merits.

One theory holds that these tumors arise from rests or displacements of bronchogenic cells, probably arising from the third and fourth bronchial arches, which are brought into the thorax by the descent of the diaphragm and the heart. As a result, tumor tissue is found in the superior and anterior mediastinum anterior to the great vessels and often in contact with the pericardium. It may also occur in conjunction with the thymus. The fact that thyroid tissue is so frequently found lends strong support to this theory.

Other theories are the germ cell hypothesis, the hypothesis of extragonadal germ cells, the hypothesis of fertilized polar bodies, the hypothesis of displaced blastomeres, the morphogenetic hypothesis, the hypothesis of tissue dislocation with liberation of organizers, and the hypothesis of "fetus in fetu."

The highly differentiated, extremely complex teratoma, which is occasionally found, may well be the result of a fertilized polar body

which grows and becomes more or less a parasitic fetus, the so-called fetus in fetu, or the included twin.

CLINICAL PICTURE

Many of the symptoms and signs produced by the tumor are directly referable to its growth and pressure on the surrounding structures. According to Rusby [4], a cough which may be dry or productive is the most frequent and outstanding symptom. This cough may be constant, but it is more frequently paroxysmal and is often brought on by a change in position of the patient. Often, the coughing is least in the sitting position, and is aggravated when the patient lies down. The sputum may be clear, blood-tinged, or may contain clay-like particles and hairs. The latter is pathognomonic of mediastinal teratoma, and is the result of the formation of a fistula between the tumor cavity and a bronchus. The hairs, if expectorated, are only produced after a great deal of coughing. It is thought that the sebaceous material clogs the fistula and is only dislodged after an unusually strong cough.

Cough is often associated with dyspnea. Dyspnea is commonly regarded as being the result of pressure on surrounding lung tissue or on the large pulmonary vessels, or both. Associated chest pain, in a large majority of the cases, is pleuritic in nature and is aggravated by movements of the chest. Some patients, however, complain of a pain which is of anginal type, with radiation down the ulnar aspect of the left arm. Neck veins may become engorged and the face swollen if venous obstruction is sufficient. If venous obstruction is marked, ankle edema, ascites and even anasarca may result. According to Rusby [4], palpitation of the heart is frequent and due to pressure on the heart itself or displacement of it by the tumor mass. Often an arrhythmia is produced, which may take the form of a paroxysmal tachycardia.

Pupillary changes, according to Rusby [4], are quite rare, although Heuer recorded one instance of a full Horner's syndrome being produced. There is often pressure on the left recurrent laryngeal nerve which gives rise to a husky, hoarse voice.

Physically, the patient may present dullness to percussion over the mass, marked fullness or protrusion of the affected side of the thorax, diminished to absent voice and breath sounds, and possibly a pleural effusion. Often a pulsating mass is seen in the chest. It must be remembered, however, that there may be no signs at all until the thorax is x-rayed.

DIAGNOSIS

The diagnosis often is difficult or impossible to make before the tumor is operatively excised. There are three procedures, however, which may lead one to a positive diagnosis before operation. The first of these, which has already been mentioned, is a positive Aschheim-Zondek test in the presence of a known tumor mass in the mediastinum. Another is the presence of hairs in the sputum. A third is the aspiration of the contents of the cyst cavity and the examination of the aspirated material for hairs and sebaceous material.

Roentgenologic examination may often give definite diagnostic clues as to the nature of the pathologic process. According to Good [9], in almost one-half of teratoid tumors there is roentgenologic evidence of a calcific process. This calcification may be seen in the cyst wall, in bone formed within the tumor, or in teeth seen in the tumor substance. He claims that the presence of a well formed tooth is pathognomonic of a teratoid tumor if the location of the tumor is the anterior mediastinum. On x-ray examination, the tumor may be ovoid or lobulated, with either distinct or indistinct borders. In many cases, especially those with fistula formation, an air-fluid level may be demonstrated in the cyst cavity.

COMPLICATIONS

As has already been mentioned, this usually benign condition may undergo many complications. For one, the tumor may become infected. This inflammatory process may cause a great increase in size, leading to pressure symptoms within the thorax; or it may weaken the cyst wall in such a manner as to bring about rupture of the cyst into adjoining structures such as the pericardium, the superior vena cava and the pleural cavity. Inflammatory change may bring about the development of adhesions to adjacent structures which may cause the surgeon a great deal of difficulty. Parts of the tumor may undergo malignant degeneration. When this happens, there is almost invariably a rapidly fatal termination.

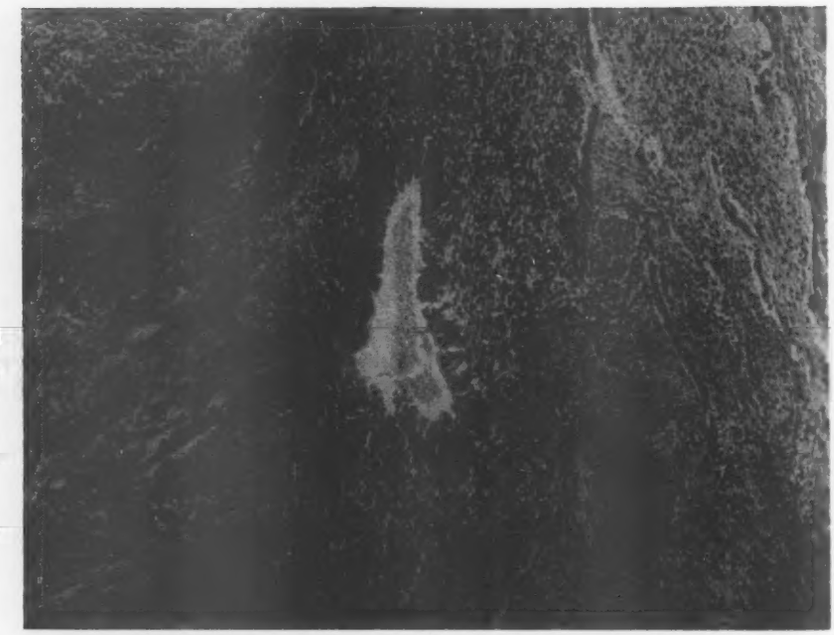

FIG. 1. Gland-like space, lined by pseudostratified ciliated columnar epithelial cells, such as are found lining the tracheobronchial tree (entodermal origin). Phloxine methylene blue stain, original magnification × 160.

DIFFERENTIAL DIAGNOSIS

There are several factors which must be considered in the diagnosis of this lesion. Because the condition is usually manifested by a series of non-specific symptoms, the diagnosis is often impossible to make. Tumors of the lymphoma series, notably lymphosarcoma and Hodgkin's disease, must be ruled out. These respond to deep x-ray treatment and the drugs of the nitrogen mustard series, whereas teratoid growths do not. Ganglioneuroma is infrequently seen, and is usually located in the posterior mediastinum when present. Since the teratoid tumor often is seen as a pulsating mass, a syphilitic or arteriosclerotic aortic aneurysm must be considered. Wassermann and Hinton tests are an aid here. Often, the lipoma cannot be excluded and attempts at aspiration yield nothing. Thymoma is usually malignant and is sometimes accompanied by myasthenia gravis. Biopsy is the only way to distinguish an occasional huge bronchogenic carcinoma from the teratoid tumor. In areas of the country where Echinococcus granulosus is prevalent, the hydatid cyst must be excluded. Another possibility, especially in the Great Lakes region, is a retrosternal goiter. Tuberculosis of the mediastinal glands, xanthoma and neurofibroma are seen almost exclusively in the posterior mediastinum. The possibility of a solitary cyst of the lung or bronchus and a pericardial cyst must be considered.

The teratoma shown microscopically in Figures 1 to 3 was not located in the mediastinum, but may be regarded as a prototype of mediastinal teratomas.

CASE REPORT

J. R., a twenty-six year old white man, was originally seen on October 22, 1955. His chief complaint was a mass in his neck of one year's duration. For the previous month he had begun to have difficulty swallowing. He also stated that he had been troubled for the past few weeks with irritability, "jumpiness," nervousness, etc.

Past history was irrelevant except that right inguinal herniorrophy had been performed in 1952 at an Army Hospital in Munich, Germany.

Physical examination revealed a well nourished and well developed white male who appeared to be of the stated age. His weight was 145 pounds. His height was 5 feet, 7 inches and his blood pressure was 160/110. A grade III enlargement of what was thought to be both lateral lobes of the thyroid gland with a large substernal extension was noted. There were no associated nodules and the mass was soft,

FIG. 2. Area of bone formation, set in a matrix of fibrous connective tissue, with bone fragments bordered by a line of osteoblasts (mesodermal origin). Phloxine methylene blue stain, original magnification × 160.

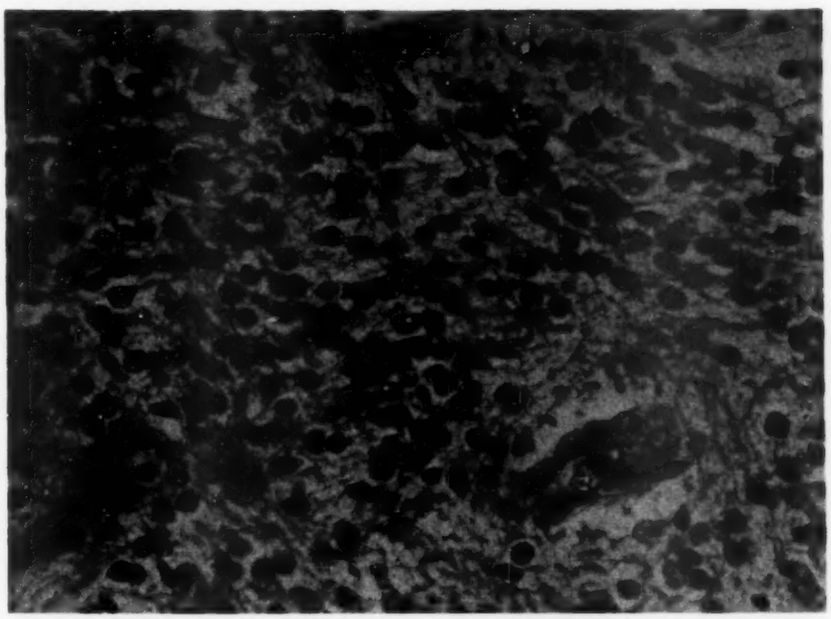

FIG. 3. Area containing glial-type cells, as found in the central nervous system. Abundant larger cells resemble astrocytes; smaller ones resemble oligodendroglia. Phloxine methylene blue stain, original magnification × 450.

which was thought to be probably secondary to cystic degeneration.

A basal metabolic study was reported as plus 35, but clinically the patient did not appear to be toxic. Therefore, radioactive iodine studies were carried out and reported as "within normal limits."

Chest x-rays, especially of the superior thoracic strait, were reported by Dr. W. Arthur Young as follows: "The outline of the cardio-

vascular system is not remarkable. The bronchial pattern is moderately prominent in each lung, being more so on the right. There is no x-ray evidence of consolidation, infiltration or pleural effusion. Both hilar shadows are somewhat prominent, especially on the left superiorly, and for this reason, additional chest x-rays at some future date should be done if clinically indicated."

The patient was admitted to the Booth Memorial Hospital, Brookline, Massachusetts, on October 27, 1956, and on the following day what was thought to be an adenomatous goiter with cystic degeneration and substernal extension was removed as follows:

Under adequate inhalation anesthesia, and with the patient intubated and in the usual position for thyroidectomy, the anterior aspect of the neck was prepared with ether and zephiran® and properly draped. A low collar skin incision was made and carried down through the subcutaneous fat and platysma muscle to the anterior level of the deep cervical fascia. The upper flap was then dissected proximally as far as the cricoid cartilage. The medial aspect of both sternocleidomastoid muscles was then freed up. The deep cervical fascia was divided vertically in the midline, after which the strap muscles were divided high between Kocher clamps. It was then revealed that the trachea was markedly deviated to the left because of the large mass involving the right lateral lobe of the thyroid. The right lateral lobe was grasped with double hooks and rotated medially, after which the superior thyroid pole was doubly ligated with heavy catgut.

By sharp dissection, the right lateral lobe was freed up from the carotid sheath. Extensive adhesions were found between the carotid sheath and the right lateral lobe. The inferior thyroid artery was ligated in continuity; then by sharp and blunt dissection the substernal extension was freed up down to the aortic arch. All bleeding vessels were clamped and ligated with fine and heavy plain catgut sutures. Because of persistent oozing, a gelfoam® pad was placed in the defect in the superior thyroid strait and the strap muscles were brought together with lateral mattress, heavy, plain catgut sutures. The deep cervical fascia was brought together in the midline with interrupted heavy, plain catgut sutures, and the skin with Michel clips. A small Penrose drain was allowed to make its exit from the wound at the right lateral pole of the wound. A dry, sterile pressure-type dressing was applied.

Postoperatively the patient did well and he was discharged from the hospital improved on his fifth postoperative day.

The pathologic report was as follows:

Clinical impression: Thyroid adenoma, right, with substernal extension and cystic degeneration.

Grossly, the specimen consisted of a portion of thyroid tissue weighing 26 gm. and included the wall of an empty open cyst. Recognizable thyroid tissue measured 3.0 by 2.5 by 1.5 cm. The cystic portion measured 4.5 by 4.0 by 2.5 cm. The thyroid tissue was pinkish red and glistening. The outer surface of the cystic structure was, for the most part, smooth and yellowish white. There appeared to be a second and collapsed cyst attached to the large cyst noted in conjunction with the thyroid tissue. This cyst measured approximately 1.5 cm. in its greatest diameter. Multiple sections revealed glistening yellowish white tissue between the cyst wall and the thyroid. The lining surface of the larger cyst was hemorrhagic and rough. A third cyst was found in the substance of the wall of the mass. This was multilocular in appearance. The walls of the locules were composed of a soft yellowish green, somewhat gelatinous material, and in the cystic area a dirty grey-brown fluid was encountered.

Preliminary gross diagnosis: Adenoma, thyroid, showing cystic and hemorrhagic necrosis.

Final diagnosis: Cystic teratoma attached to thyroid and thymic tissue complicated by chronic inflammation. The teratoma contained recognizable pancreatic tissue, small intestinal mucosal glands, smooth muscle, skeletal muscle and fibrous tissue. The lesion was benign.

One year later, follow-up studies revealed a non-disfiguring low collar skin scar and no evidence of recurrence. Mediastinal x-rays at this time were reported as normal.

TREATMENT

All authors seem to agree unanimously that surgical intervention is the only treatment of any use in this condition. Rusby [4] lists three accepted lines of surgical approach. The first, rib resection and drainage, has little to offer if this is the only treatment rendered the patient. The results are poor, but this method is acceptable if it is used as a preliminary to more extensive surgery. Second, if the tumor is

firmly bound down to adjacent vital structures, the usual procedure is that of partial removal with marsupialization. Indeed, this may be the only possible course to take. This step does not preclude the possibility of a more radical intervention at a later date. Many surgeons employ this as the first step in a multiple stage, resulting in complete removal of the tumor. If this is the only treatment, the results are only slightly better than those obtained with rib resection and drainage.

The surgeon's aim should always be complete excision of the mass. Rusby thinks the transpleural approach is best if concomitant infection is feared or the neoplasm is large. For tumors located in the upper retrosternum, the transverse cervical collar incision with splitting of the sternum is the accepted method. The trap-door incision is effective for a growth located in the thoracic substernal region, but not in the lateral thoracic region. Harrington [*10*] is an exponent of the posterior approach, for he believes that there is a significantly better exposure obtained in this manner.

CONCLUSION

A mediastinal teratoma is described which preoperatively was diagnosed as an adenomatous goiter.

Needle biopsy of tumors in the neck is to be discouraged as probably in this instance an erroneous diagnosis of adenomatous goiter with cystic degeneration would have been made if only needle biopsy had been performed.

The history, pathology, pathogenesis and clinical picture of mediastinal teratomas are reviewed.

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Automobile Collision with Simultaneous Bilateral Dislocation of the Hip

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THE ever increasing number of crash injuries demands, in addition to greater clinical efforts, a more unified or biomechanical approach to the problem as a whole, as will be illustrated in the following case.

CASE REPORT*

A thirty-two year old man was driving a 1949 sedan about 55 miles per hour when he collided with an oncoming truck going approximately 35 miles per hour. On admission to the St. Joseph's Hospital he appeared to be in shock but his blood pressure was 115/78. Severe pain associated with marked lower abdominal and adductor spasm was present. X-ray examination (under general anesthesia) disclosed bilateral posterior dislocation of the hip associated with fracture of the left acetabulum and left femoral head. (Fig. 1.) There was also a linear fracture of the right ilium running

* Patient was referred by and treated with Dr. Joseph F. Chiarrottino of St. Joseph, Missouri.

FIG. 1. X-ray film of the pelvis on patient's admission to hospital showing bilateral posterior dislocation of both hips associated with fracture of the left acetabulum, femoral head and right ilium.

FIG. 2. X-ray film of the pelvis about six months after injury. (Courtesy of Dr. Jerome Finder of Chicago, Illinois.) Slight but definite osteoarthritis is notable on the left side.

through the right sacroiliac joint, without displacement of the fragments.

The right hip was quite easily reduced by manual traction on the thigh flexed at 90 degrees. The left hip required several attempts and was finally reduced by combined traction in the long axis of the limb and lateral pull by a sheet looped around the upper thigh. The legs were then tied together for several days. On the following day, in response to the patient's complaint of pain over the sternum, x-ray films showed a fracture of the upper portion of this bone. No treatment was deemed necessary for this injury. He was in a wheelchair in two weeks and allowed on crutches one month later. These were discarded gradually, and his progress was deemed satisfactory some months later. (Fig. 2.)

About five years after injury he was actively employed as a high school athletic coach but stated that his left hip stiffened up after rest periods and weather changes, which prevented active participation in the more robust contact sports such as basketball. His gait was normal and the right hip was asymptomatic, although this side was about ½ inch shorter than the other. There was little or no limitation of motion on the right side. The left hip flexion was limited to 90 degrees. The Trendelenburg tests were negative bilaterally. X-ray films (Fig. 3) showed secondary osteoarthritis, more advanced on the left side, without evidence of aseptic necrosis of the femoral heads and complete healing of all fractures.

COMMENTS

Certain biomechanical aspects of this accident need further mention. The magnitude of the crash forces generated is dramatically shown in Figure 4, especially when the extensive structural deformation on the outside is compared with the relative intactness on the automobile's inside ("accident within an accident"). It is to be noted that the right front windshield was broken, the steering wheel was deformed, the front seat was displaced forward

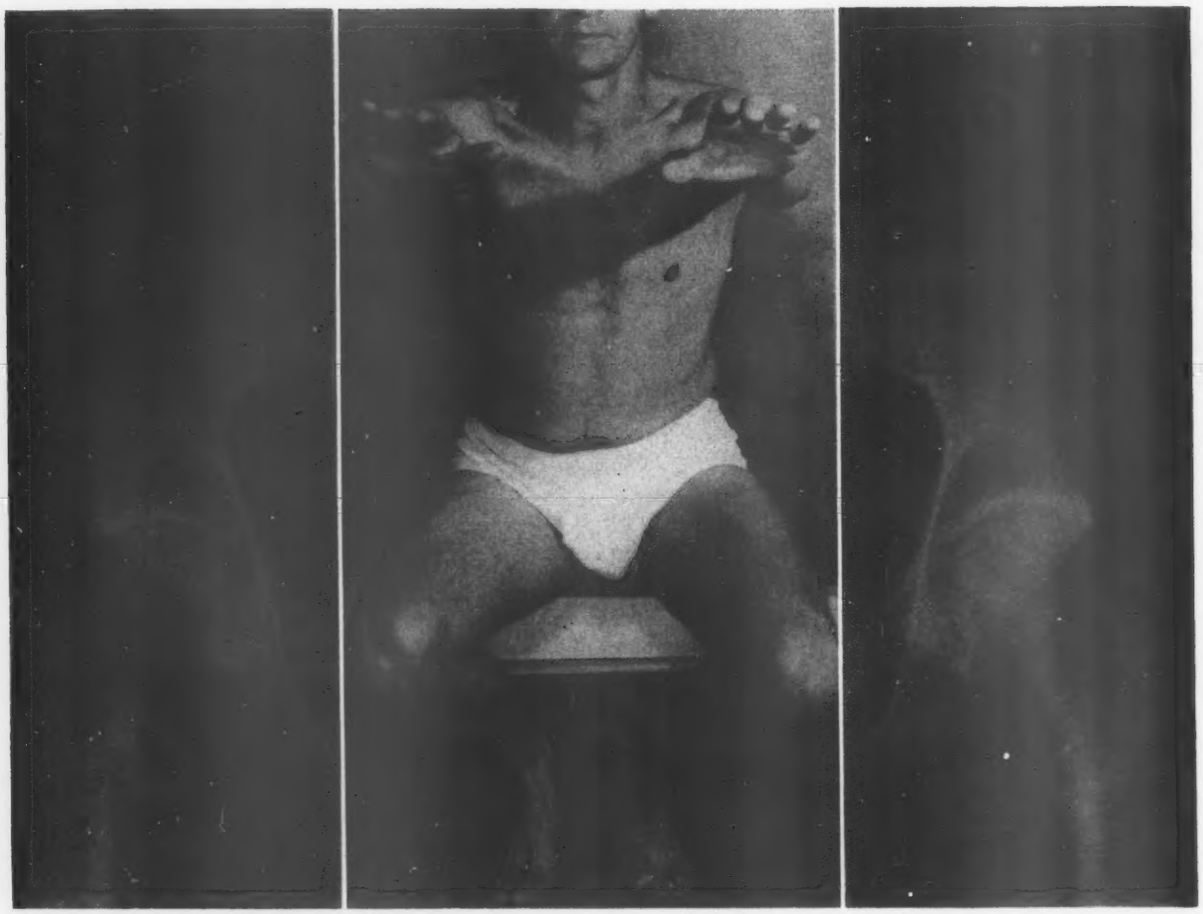

FIG. 3. X-ray film of the pelvis and photograph of patient squatting about five years after injury. There is bilateral osteoarthritis of the hips and slight limitation of flexion on the left side.

and there were several less prominent deformations on each side of the steering column involving the dashboard. The discrepancy between outside and inside structural damage was also reflected with respect to the occupant injuries, making this a perfect epitome in mechanical and human variables.

Thus, a teen-aged youth who was asleep on the right front seat impacted the windshield and received facial lacerations and a sprained right ankle. Also, three youths who were asleep in the back seat escaped injury entirely. By contrast, the patient abraded his forehead on the steering wheel, impacted the wheel with his chest, and impacted both knees on the dashboard and his abdomen against the lower part of the steering wheel. Several factors contributed to his survival. First, his automobile was pushed backward about 75 yards before coming to a stop (prolonging and lengthening his declerative distance, after structural peaking). Second, the car absorbed most of the crash energy through deformation. Third, the cabin remained relatively intact, thus excluding crushing forces (and/or forcible ejection). This is requisite for survival. Fourth, his impacts must have been quite simultaneously distributed over areas of the body thought to be quite tolerable to linear declerative force, i.e., anterior chest, abdomen and knees. Fifth, but by no means least, he was in excellent general physical condition at the time of accident. This, too, is requisite for survival in high energy crashes, especially in the absence of any kind of safety barriers or safety gear.

While it is true that bilateral dislocation of the hip (and even unilateral dislocation) is relatively uncommon, the general dynamic decelerative human pattern is not. On the contrary, this is quite repetitive with respect to knee-dash impacts. Figure 5 illustrates this point, which indicates in essence that all injuries produced by this mechanism make this reaction a keystone in an evolving biomechani-

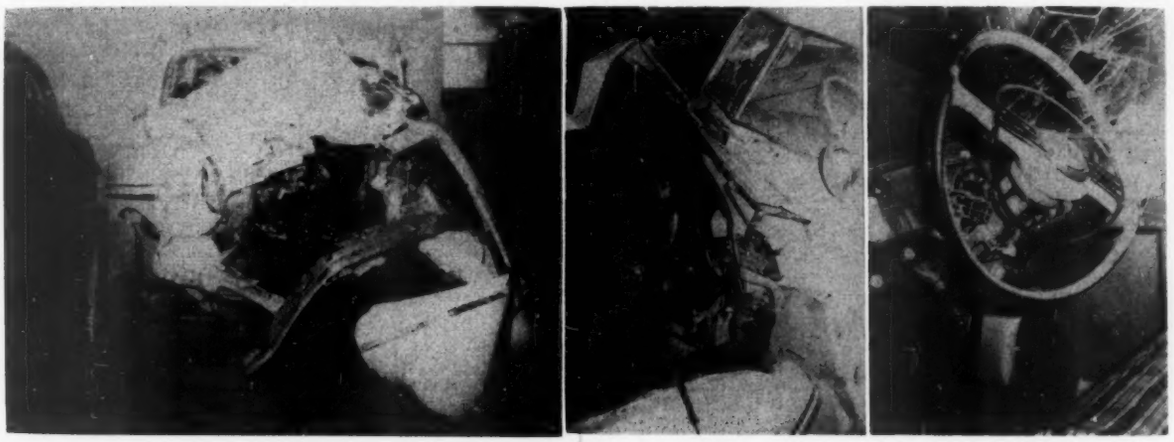

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FIG. 4. Photographs of patient's car after impact. A, crushed left front side. B, side view of crushed left side of car. C, car compartment after impact. Most notable deformations involve the right windshield, steering wheel (above and below), dashboard and forward shift of the front seat.

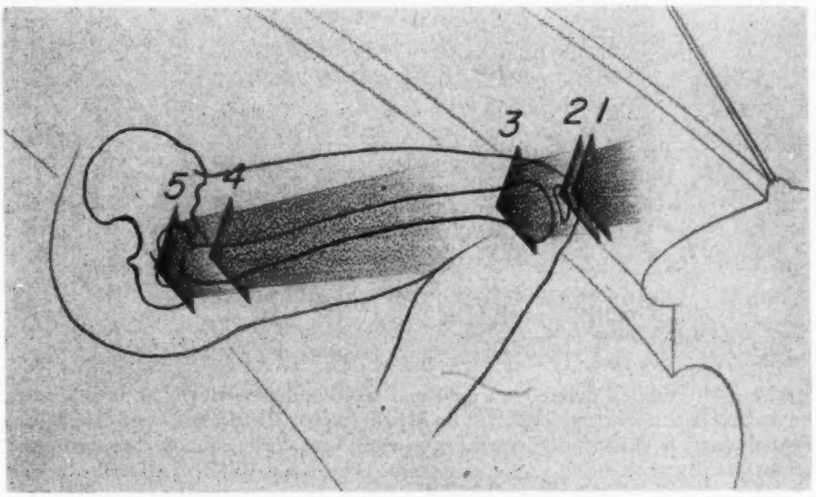

FIG. 5. Transmission of force, showing repetitive nature of the basic knee-dash impact pattern with injury potentials ranging from the knee proximalward to the hip and pelvis, from unidirectional forward reaction of the body under forward crash conditions. Any single injury along the femoral and parafemoral pathway is relatively uncommon, but taken together the total number makes this mechanism of injury of universal significance from the biomechanical standpoint. The pathogenesis, not the isolated lesions, is the basic factor to be considered. (From: KULOWSKI, J. Clinical Orthopaedics (DePalma), vol. 7, p. 250. Philadelphia, 1956. J. B. Lippincott Co.)

cal concept of sublethal motorist injuries. The implications with respect to crash-impact engineering are obvious, but are underscored even more so from the standpoint of bodily linkages as they relate to this kind of injury.

To begin with, the patient had no time to brake his car but he was aware of the impending crash and braced against it instinctively on the steering wheel and floor boards with his hands and feet, respectively. This simple action changed his bodily open chain linkages into so-called closed kinetic chains. (Fig. 6.) Moreover, he probably added his own intrinsic muscular forces to those applied externally on impact, and gave a directional or unidirectional reaction not usually manifested under crash conditions, i.e., almost straight forward (or at least minimizing vertical, lateral and rotational kinematic bodily movements). Be that as it may, biomechanical concepts stress the dy-

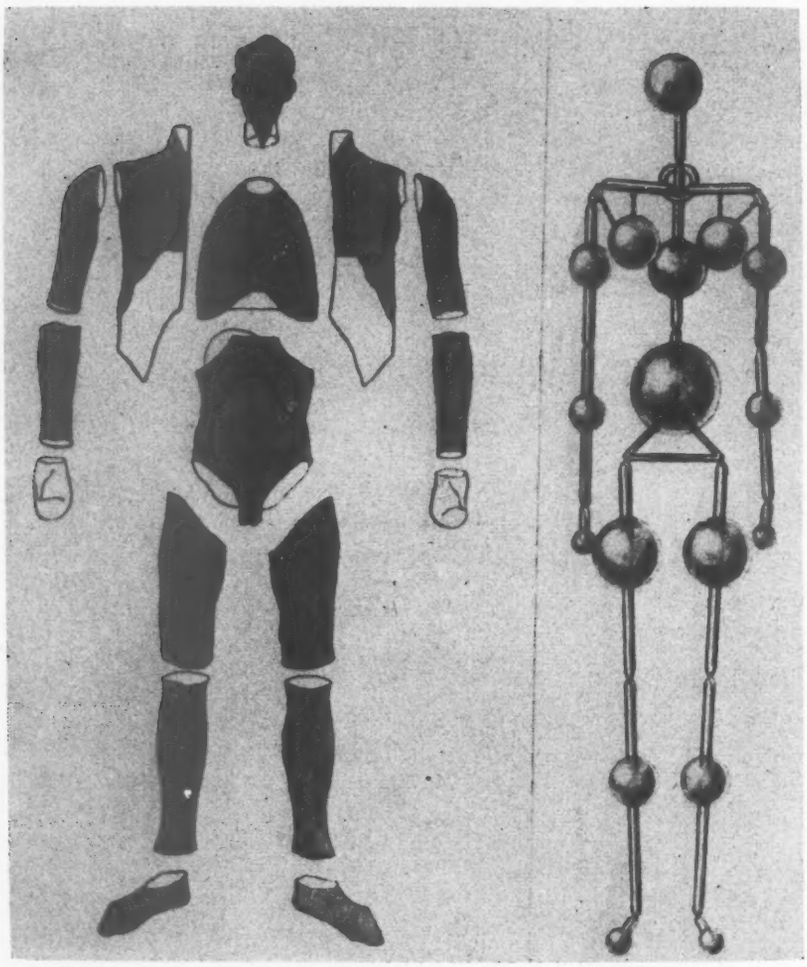

FIG. 6. Plan of body dismemberment and relative masses of the body segments engrafted upon the concept of bodily linkages. This idea, applied to the seated position of the rider, clarifies the varied results of impacts involving the femoral and parafemoral linkages. (From: DEMPSTER, W. T. The anthropometry of body action. *Ann. New York Acad. Sc.*, 63: 559, 1955.)

namic and spatial aspects of motorist injuries, and also the spatial cooperation which automotive engineering and design must furnish with respect to crashproofing requirements.

The post-traumatic osteoarthritis of the hips focuses attention upon medicolegal rehabilitation of these victims. In orthopedic practice, about one-half of the patients with residual disabilities of the motor-skeletal system (from motor vehicle accidents) will require some kind of disability rating, and about one-half of these people happen to evidence varying degrees of osteoarthritis as an accessory diagnosis. Ideas with regard to causal relationships and/or aggravational influence on a pre-existing condition must be highly individualized. Experience has taught that these complications are usually progressive, but how fast and to what degree cannot be predicted accurately.

CONCLUSIONS

The case reported and discussed illustrates the basic nature of motorist injuries involving the femoral and parafemoral linkages of the body, even though this type of case represents one extreme or limits of sublethal injury under forward linear crash deceleration. On the clinical side was mentioned one difficulty encountered regarding closed reduction (due to the associated fractures on the left side). With respect to prophylaxis or crashproofing, the universal force reaction pattern emphasizes the three fundamental requirements needed, i.e., intact compartment, spatial cooperation to pre-

vent lethal impacts inside and safety restraint of occupants. Since the external impact involved the respective driver sides of the vehicles, Dye's ideas with regard to central positioning of drivers is fundamentally sound (as are others to be incorporated in the so-called Cornell safety automobile).

The biomechanical concept and approach yields a most universal point of reference which orients both engineering and law to medicine.

Perhaps the time has come to channel and coordinate the efforts of medicine, engineering and law with the hope that the daily traffic toll may be reduced to more acceptable levels of control.

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We recommend:

Synopsis of Gastroenterology. By Rudolf Schindler, M.D., F.A.C.P., Clinical Professor of Medicine (Gastroenterology), College of Medical Evangelists, Los Angeles, California. 395 pages, with an index. New York, 1957. Grune & Stratton, Inc. *Price* $7.75. (Written specifically for the general practitioner and the internist. Many surgeons will find it an aid in their work.)

Clinical Neuro-Surgery. Proceedings of the Congress of Neurological Surgeons, Los Angeles, California, 1955. Eleven contributors. 261 pages, 131 figures, with an index. Baltimore, 1957. The Williams & Wilkins Co. *Price* $10.00.

Fractures of the Anterior Process of the Calcaneus

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FRACTURES of the calcaneus are quite common, and the literature regarding such fractures is voluminous [1,4,6,10,12,13,15,20–22]. However, isolated fractures of the anterior process of the calcaneus are rarely reported [2,3,5,8,9,11,17] and, even in comprehensive papers dealing with calcaneal fractures, are frequently not mentioned or are briefly dismissed. Twelve such fractures have been found in the past eighteen months at Misericordia Hospital, Philadelphia. We believe that these fractures are more common than reported.

These fractures may easily be missed on roentgenograms, or their symptomatology may be such that they are treated as a sprain without benefit of roentgenograms. Such fractures, if not treated or if inadequately treated, lead to long term disability due to persistent pain which the patient localizes in the region of the ankle joint. Even when the fractures are adequately treated, the patients sometimes suffer persistent pain for varying periods of time.

The purpose of this article is to emphasize the importance of routine adequate roentgenographic examination of all patients complaining of pain in the ankle joint following indirect trauma, no matter how seemingly trivial the trauma may be.

Age and Sex Incidence. Eleven of our twelve patients were women. The ages of the patients varied between twenty-seven and fifty-six years. The average age was forty-four years. It is interesting to note that in two of our patients the fracture occurred during pregnancy.

Pathologic Anatomy and Differential Diagnosis. According to Astrup [2], "On the anterior portion of the calcaneus, there is a pea-sized, bill-shaped tuberosity, lying at the distal lateral corner above the articular facet for the cuboid bone and lateral to the tendon of the talus. The tendons of the ligamentum bifurcatum which connect the calcaneus with the navicular bone and the cuboid bone, originate on this tuberosity. It is this tuberosity which, with certain lesions, is torn off and lies as a free bony fragment. (11) Once in a while a second calcaneal bone known as calcaneus secondarius is found in this same region, and fractures that occur in the anterior process must not be mistaken for this (2)."

The free tuberosity referred to in the foregoing description has been described in various publications [2,8,14,17,18]. A roentgenogram of the opposite foot in comparison with the injured foot helps in the differential diagnosis. Fresh fractures with frayed edges present no problem in differential diagnosis, but old, ununited injuries must be differentiated with care. Sesamoid bones are usually round or oval and have a uniform cortex. However, they may be other shapes [14]. Ununited fractures of this tubercle are usually triangular and may have a sclerotic edge. Secondary epiphyseal centers have not been reported in this location.

Some people have contended that these fractures are all instances of secondary ossicles rather than being true fractures. That this is not the case is especially well illustrated by Figures 1 to 4.

Mechanism of Fracture. Fracture invariably occurs by indirect violence. This is often of a shearing type [9]. The mechanism of the fracture is variously described by several authors. In our series of cases all fractures were due to a twisting of the foot. In one case the twisting occurred when the patient arose after having been in a sitting position with her leg and foot flexed and sitting on the leg, throwing it into inversion and plantar flexion. The fracture occurred without any weight bearing.

FIG. 1. Mrs. C. P. Roentgenogram of left foot in 1951, showing uninjured anterior tubercle of os calcis.

FIG. 2. Mrs. C. P. Roentgenogram of left foot on April 11, 1955, at time of acute injury, showing fracture of anterior tubercle of os calcis.

FIG. 3. Mrs. C. P. Roentgenogram of left foot on May 5, 1955, at time of removal of cast following early union.

FIG. 4. Mrs. C. P. Follow-up roentgenogram one year after injury, showing complete healing.

FIG. 5. Mrs. G. McG. Roentgenogram of right foot showing fracture of anterior process of os calcis with considerable displacement.

FIG. 6. Mrs. G. McG. Roentgenogram of right foot showing fracture of anterior tubercle of os calcis with film taken in direct lateral view.

TABLE 1—STATISTICAL DATA
FRACTURES OF ANTERIOR TUBERCLE OF OS CALCIS

Type of accident:	
Twisted ankle	2
Fall through board	1
Fell on ice	1
Slipped on floor	4
Missed step	2
Undetermined	2
Site of pain:	
Top of foot	1
Outer side of ankle	5
Back of ankle	1
Diffuse over lower leg and ankle	4
Undetermined	1
Onset of pain:	
Immediate	11
Within 1 hr	1
Onset of swelling:	
Immediate	12
Delayed	0
Position of foot at time of injury:	
Inversion	1
Eversion	2
Inversion and plantar flexion	1
Plantar flexion	6
Undetermined	2
Interval from injury to medical care:	
12 hr	3
24 hr	6
8 days	1
5 wk	1
Undetermined	1
Interval from first medical visit until x-ray:	
12 hr	2
24 hr	6
48 hr	1
8 days	1
5 wk	1
Undetermined	1
Method of treatment:	
Cast only (base of toes to tibial tubercle)	6
Cast and walking heel	4
Cast, walking heel and crutches	2
Length of immobilization:	
3 wk	2
5 wk	1
6 wk	2
8 wk	5
10 wk	1
Undetermined	1
Disability:	
Length of time occasional pain persisted:	
6 wk	1
5 mo	3
7 mo	2
12 mo	2
14 mo	1
Undetermined	3
Length of time occasional swelling persisted:	
1 mo	1
5 mo	4
7 mo	1
12 mo	2
14 mo	1
Undetermined	3

In reviewing our cases we have noted a considerable variance in the degree of elongation and prominence of this anterior tubercle. It would appear that most of the patients with this type of injury have a more prominent anterior process. The prominence of this anterior process may contribute to an easier injury of it with a twisting motion.

Clinical data relative to the mechanism of the fracture in our other cases and treatment administered are listed in Table 1.

X-ray Diagnosis. These fractures are not visible on routine anteroposterior views of the foot or ankle nor plantar-dorsal axial (tangential) view of the calcaneus. They are seen on the lateral view of the foot but are best demonstrated in the oblique view of the posterior foot made as follows: "The patient lies on the table rolled well onto the affected side, the dorsum of the foot resting on the cassette, opposite leg flexed at the knee and drawn upward and forward out of the way. Place the bar supporting the x-ray tube parallel to the long axis of the foot and project the principal ray at the angle of 15° toward the head so that the principal ray is centered over the midportion of the sole of the foot" (Sante [*19*]). (Figs. 5 and 6.)

SUMMARY

The isolated fractures of the anterior process of the os calcis are much less frequent than other types of fractures of the calcaneus. We believe that these fractures are more common than reported. Twelve such fractures have been seen by us in the past eighteen months. The prolonged disability in injuries of this process is due to the associated injury to the ligamentum bifurcatum. Recognition of the fracture depends on the awareness of its occurrence and proper roentgenographic examination of the area.

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Pneumatosis Cystoides Intestinalis Diagnosed Sigmoidoscopically

REPORT OF CASE AND REVIEW OF LITERATURE

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PNEUMATOSIS cystoides intestinalis is a rare disease of unknown cause, usually discovered as a surprise at laparotomy performed for pyloric or duodenal ulcer, or for some lesion that is producing partial intestinal obstruction. In the majority of reported cases the disease has involved primarily the small bowel. Involvement of the colon, when it occurs, is usually confined to the right side and is usually associated with similar changes in the ileum.

In a survey of the world literature, we have been able to find reports of only seven cases in which the changes of pneumatosis have been described on sigmoidoscopic examination [*3,6, 8,13–15,20*]. All of these cases have been reported within the past seven years, and five of them have been reported in the British and American literature within the past two years. It appears that the correct diagnosis was established initially at sigmoidoscopy in only two of the seven cases [*3,20*].

We recently examined a patient in whom the diagnosis of pneumatosis cystoides intestinalis had been established, prior to referral to us, by sigmoidoscopic and roentgenologic examinations. This appears to be the first case of pneumatosis ever encountered at the Mayo Clinic in which the lesions were evident at sigmoidoscopic examination. The details of this case are to be published in the near future from another source.* Within three weeks after this patient was examined, the diagnosis of pneumatosis was made in a second clinic patient by sigmoidoscopic examination. A report of this case follows.

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CASE REPORT

A sixty-six year old white man was first seen at the Mayo Clinic in 1946, at which time he was hospitalized because of acute myocardial infarction. He had been told ten years previously that he had hypertension, and for eight years he had experienced symptoms of angina pectoris. Convalescence from the myocardial infarction was uncomplicated. He was seen again in 1951, several weeks after a mild cerebral vascular accident, the signs of which subsequently cleared up completely. The hypertension remained consistently severe during the time he was under observation, the pressure ranging from 215 to 250 mm. Hg systolic and from 115 to 130 mm. Hg diastolic.

The patient was first seen in the section of proctology on June 24, 1955, when he complained of intermittent, "slight," rectal bleeding of two weeks' duration. Sigmoidoscopic examination to a distance of 24 cm. from the anal verge disclosed, beginning at 14 cm. and continuing to the upper level examined, at least a dozen large, submucosal, cyst-like lesions projecting into the lumen of the bowel after the fashion of very large, sessile polyps. Their diameters varied from 2 to 4 cm. (Fig. 1.) The mucosa investing the lesions, along with the intervening mucosa, appeared normal. The cystoid character of the submucosal nodules could be fairly clearly discerned, in some areas, through the semi-transparent overlying mucosa. Most of the lesions appeared honeycombed, that is, multilocular. It was believed

that the gross appearance, although not typical, might be consistent with the diagnosis of submucosal lymphoid hyperplasia. Examination of a biopsy specimen, which was regarded as being adequate and was thought to include a portion of the submucosa, disclosed normal rectal mucosa.

General physical examination revealed, in addition to the known hypertension, a slightly enlarged liver. The edge of the liver was palpable approximately 4 cm. below the right costal margin. This condition has persisted to date and has not been thought to represent significant disease of the liver. The remainder of the general examination, including roentgenologic examination of the colon, gave normal results.

The patient returned in one month, as advised, for another signoidoscopic examination. This examination revealed no essential change in the lesions. Biopsy again disclosed normal rectal mucosa.

Sigmoidoscopic examination, the third one, was made about three weeks later, on August 18th. A biopsy specimen taken then from one of the nodules was made to include deeper tissues in the hope that it would show lymphoid tissue. The results of microscopic examination, however, remained unchanged.

At a fourth examination in September, the nodules still appeared the same. Roentgenologic examination of the colon showed evidence of multiple defects in the bowel wall which were considered possibly caused by intramural tumors. Several days later, contrast studies with the aid of barium and air led to a diagnosis of multiple polyposis involving most of the colon. Since the lesions were obviously not adenomatous polyps proctoscopically, it was decided that nothing should be done then but that the patient should be re-examined three months later.

The fifth sigmoidoscopic examination was made on March 26, 1956, a little more than two weeks after we had seen the first case of pneumatosis, referred to in the introduction. Experience with the previous case plus the fact that one of the nodules in the present case deflated after biopsy led to the correct diagnosis immediately.

Roentgenograms of the colon made on antecedent visits were then reviewed and were recognized as showing the typical changes of pneumatosis. (Fig. 2.)

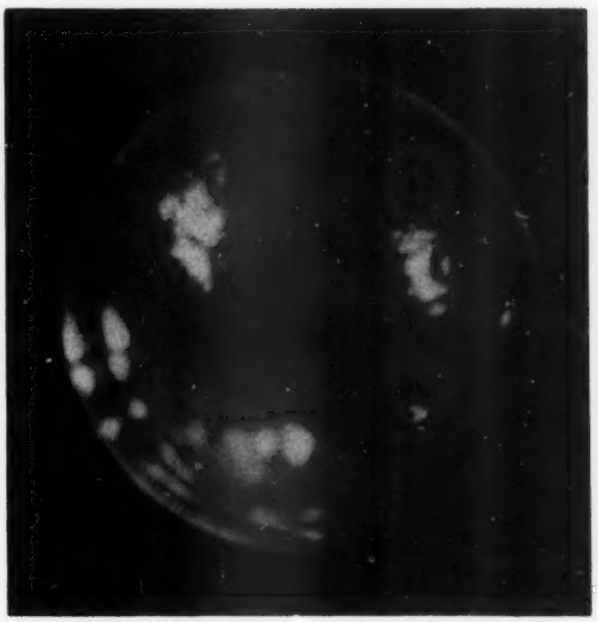

FIG. 1. Cysts of pneumatosis cystoides intestinalis as seen through the sigmoidoscope.

The only symptoms referable to the colon to date have been occasional slight rectal bleeding and rather frequent bowel movements, which the patient attributes to excessive mucus. All stools have been formed. Because the difficulty was minimal and because the patient's general condition was poor, he was sent home without any specific recommendations for treatment of his pneumatosis cystoides intestinalis.

GENERAL BACKGROUND

Numerous authors have published excellent reviews on the subject of pneumatosis cystoides intestinalis [*1,2,4,7,10,16–19,21,22*]. The following general remarks concerning the disease have, except when otherwise noted, been largely culled from these reviews. These remarks seem pertinent to further discussion.

In the series reviewed by Koss, the lesions were associated with some other abnormality of the gastrointestinal tract in 89 per cent of the cases. Fifty-three per cent of the patients had pyloric obstruction associated with either gastric or duodenal ulcer. Eleven per cent had no associated gastrointestinal disease and were said to have *primary* pneumatosis. The small bowel is by far the most frequent site of the disease. In only thirteen of the 213 cases reviewed by Koss was the large bowel involved. From the information presented, it is difficult

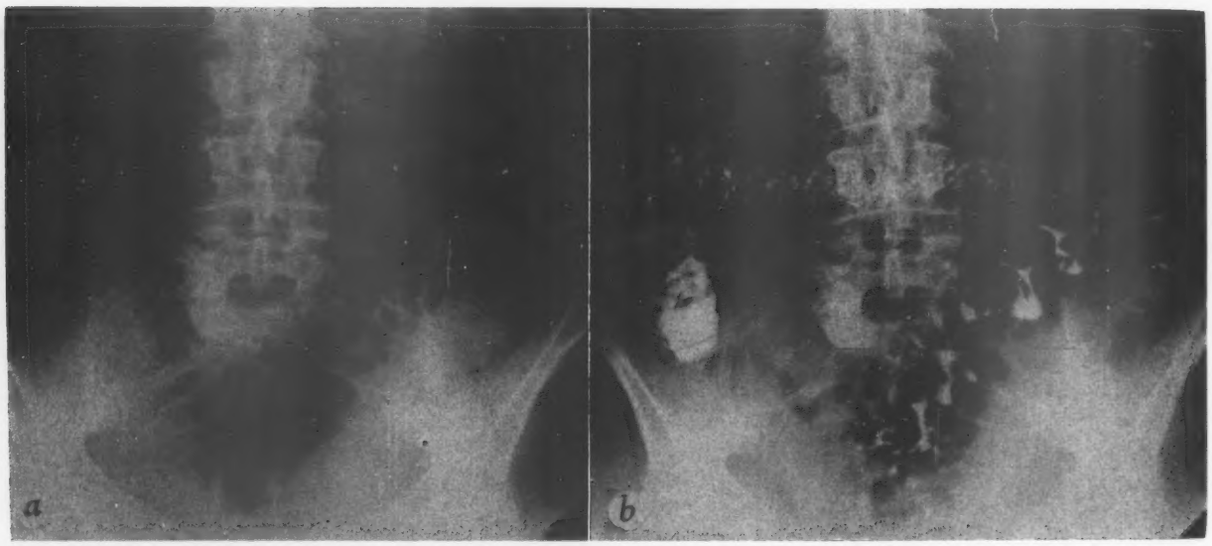

FIG. 2. Posteroanterior views of the abdomen showing typical changes of pneumatosis cystoides intestinalis of the sigmoid colon. (*a*), Plain roentgenogram. (*b*), Roentgenogram made after evacuation of a barium enema.

to determine how extensive this colonic involvement was, but the impression is gained that in most instances only the right portion of the colon was affected and that usually similar, but more advanced, changes in the lower part of the ileum were associated with those in the colon.

Most authors have concluded that the immediate cause of pneumatosis of the intestine is the presence of gas within the lymphatic channels of the bowel. The source of this extraluminal gas has been the topic of much speculation and several interesting theories have been proposed. Most investigators support, at least in part, a theory of mechanical origin. According to this theory, increased intraluminal pressure proximal to a point of obstruction in the bowel forces gas through a small mucosal defect directly into lymphatic channels, wherein it collects at various places along the bowel wall.

The gaseous collections are usually subserosal. Submucosal involvement is uncommon, but when present is usually associated with subserosal cysts. The collections of gas vary in size from that of a pea to masses 4 or 5 cm. in diameter.

The appearance of the tissue under the microscope varies with the stage of development of the lesion. In the earlier stages there is a single endothelial lining. Later, giant cells appear which are probably associated with chronic inflammation. Finally, the giant cells are sloughed, and fibrosis with scarring results. There is ample evidence that pneumatosis can develop in a relatively short time as well as disappear rapidly.

Clinical symptoms are produced by one of two mechanisms. Occasionally, a large subserosal collection of gas ruptures, resulting in spontaneous pneumoperitoneum. In the absence of the other usual signs of a ruptured viscus, treatment is not necessary in such cases. Intestinal obstruction may be produced in a variety of ways, such as by extrinsic compression or by occlusion of the bowel lumen by a large submucosal lesion. These complications apparently occur in a relatively small fraction of the cases; in their absence, pneumatosis, *per se*, is thought to be asymptomatic. Therefore, it is not surprising that the diagnosis usually has not been made before laparotomy.

A rational approach to the treatment of pneumatosis has been hampered by the lack of exact knowledge of its cause and by the relative paucity of cases of the disease. Because these lesions may regress spontaneously, conservative management is appealing. However, it now seems fairly well established that serious complications due solely to the pneumatosis occur often enough to justify operation in some cases. Surgical correction of associated gastrointestinal disease usually cures the pneumatosis. While it may be wise to excise the lesion when it is confined to a small segment of bowel, the proper management of more extensive *primary* pneumatosis remains an enigma.

ROENTGENOLOGIC FEATURES

Most authors agree that the roentgenologic features of pneumatosis cystoides intestinalis involving the colon are recognized as being characteristic, once one is aware of the condition and has observed the lesions of a known case. Because these features are so important in the preoperative recognition of the condition, it seems important to review them in some detail. The presence of pneumatosis intestinalis may be suggested on inspection of a plain roentgenogram of the abdomen. There is usually a conglomerate collection of small radiolucent shadows of gaseous density distributed along part of the course of the large bowel. The appearance of these gaseous collections has been variously described as resembling soap bubbles, cobblestones and bunches of grapes. (Fig. 2.) In addition, there may be normal intraluminal collections of gas which, however, vary in location and appearance on subsequent examinations. Pneumatosis intestinalis may be associated with varying degrees of intestinal obstruction so that the usual roentgenologic signs of this complication may be present.

Seldom has the roentgenoscopic appearance of these lesions in the colon been described in detail. Reference to this aspect is included in the paper by Lerner and Gazin [9]. One may demonstrate multiple, intraluminal, sessile, rather sharply demarcated lesions which change slightly in shape upon manipulation. They resemble multiple, sessile, polypoid masses. There is no appreciable excursion of these lesions such as may be demonstrated by a pedunculated mass. There is no fixation of the bowel or palpable mass, and seldom is any obstruction demonstrated. The gaseous density of the lesions is difficult to appreciate roentgenoscopically.

The colonic lesions are frequently well demonstrated in both pre-evacuation and post-evacuation roentgenograms following the retrograde administration of a barium and water suspension into the previously prepared colon. The typical appearance is that of the presence of multiple, smooth, sharply demarcated, usually hemispherical, sessile shadows of gaseous density lying next to and indenting the luminal barium contrast shadow of the bowel. These "filling defects" vary in size, are usually found in clusters and their gaseous outlines may be seen outside the luminal shadows. The mucosal pattern may be distorted but remains intact. The involved portions may be separated by segments which have a normal bowel outline although in some instances there may be only continuous involvement of one region. (Fig. 2*b*.)

The lesions may remain constant [11] as judged by subsequent examinations. Lerner and Gazin reported that the lesions may be inconstant and that the gas may escape from subserosal locations, pass out between the layers of the mesentery and thence dissect posteriorly and upward until it lies in the retroperitoneal space beneath the diaphragm. That this gas is not located intraperitoneally can be demonstrated by its failure to shift its position when a lateral roentgenogram is made with the patient in the lateral decubitus position. They have also reported that this gas may migrate upward into the mediastinum.

If these lesions are suspected upon observation of a routine roentgenogram of the abdomen, they usually may be confirmed by intestinal examination with the aid of a barium and water suspension. It seems doubtful that the air contrast technic is necessary to demonstrate this unusual condition.

REVIEW OF THE LITERATURE

Since direct visualization offers an unusual opportunity to study a disease, it was believed that something might be learned by reviewing previously reported cases in which the disease was encountered sigmoidoscopically. It is hoped that the results of such a review will also serve to emphasize the fact that pneumatosis intestinalis may involve the rectum and sigmoid and may be seen at sigmoidoscopic examination.

Our case is the eighth reported case in which the lesions were noted sigmoidoscopically. The case referred to in the introduction will, when reported, bring the total to nine. The first case was reported by Røjel in 1949. We chose to exclude the case of Marshak and associates [12], although they described unusual granular mucosa on sigmoidoscopic examination, because subsequent roentgenograms of the colon showed no evidence of extension of the pneumatosis to the lower part of the sigmoid. Other similar cases with sigmoidal involvement but without sigmoidoscopic findings were also excluded [5,23].

In the eight reported cases the patients were equally distributed according to sex. Their ages were between thirty-nine and seventy-five years, the average age being about fifty-two

years. All but one complained of slight to moderate bleeding from the rectum as a presenting symptom. Four patients had diarrhea which sometimes alternated with constipation. Three complained of the passage of excessive amounts of mucus from the rectum. In our case and in only two of the others was the diagnosis of pneumatosis first made at sigmoidoscopic examination [*3,20*], although apparently it was suspected in one other case [*7*]. Atypical polyposis was the most frequent diagnosis. In one instance, even without positive findings on biopsy, a diagnosis of cancer of the rectum was made and a combined abdominoperineal resection was performed before the correct diagnosis became apparent [*6*]. In Kreeger's case the diagnosis was made previously by roentgenologic methods and confirmed by biopsy of lesions in the sigmoid [*8*]. In four of five surgical cases the diagnosis was clarified by the examination of excised lesions. Griffiths' patient was operated upon because of signs of intestinal obstruction.

Only McGee's patient, who had a gastric ulcer, had any known associated gastrointestinal disease. Hence, most cases with sigmoid involvement seem to be examples of *primary* pneumatosis. In only two instances was the rectum involved [*3,6*], although in one the exact location of the lesion is not definitely indicated [*15*].

While in most patients the symptoms were of rather minor concern, all five in whom the involved segments of bowel were resected were relieved of their complaints. According to Griffiths, the lesions in the rectum of his patient disappeared three weeks after resection of the sigmoid. However, in McGee's patient the splenic flexure was still involved eight months after resection of the sigmoid. The patient reported on by Røjel was observed for the longest interval; there was no change in the sigmoidoscopic appearance of the lesions in three and a half years.

SUMMARY AND CONCLUSIONS

A case is reported of pneumatosis cystoides intestinalis in which the diagnosis was made sigmoidoscopically. The results of a review of the literature are presented. Only seven other instances were found in which such lesions of the lower part of the colon were evident sigmoidoscopically. Six of these cases have been reported within the past two years. The observations made in these eight cases suggest that:

1. The increased frequency with which this condition has been reported in the literature during the past two years seems to indicate that the disease is becoming more prevalent, more frequently recognized, or both.

2. There are rarely any definitive diagnostic symptoms when the lesions are confined to the sigmoid colon. It does seem significant, however, that rectal bleeding without any other apparent cause was experienced in seven of the eight cases.

3. The appearance of the lesions on sigmoidoscopic examination is so striking that the diagnosis usually should be apparent if one is aware of this condition. The lesions may vary in size from that of a pea to masses 4 or 5 cm. in diameter. The overlying mucosa, although pale, otherwise appears normal. Frequently the honeycombed appearance of the submucosa is seen through the semi-transparent mucosa. Not infrequently the lesions, when punctured, deflate with a popping noise, revealing the presence of gas [*14,20*].

4. Since in most of the cases the lesions were not associated with any other gastrointestinal disease, the pathogenesis remains even more obscure than it does for pneumatosis of the small bowel, which is frequently associated with peptic ulcer or other obstructing lesions.

5. Therapy of pneumatosis of the lower part of the colon seems to be an individual problem. Although there is good evidence that the process may disappear spontaneously, there is equally good proof that it may persist for a number of years. Generally speaking, the symptoms are benign enough to justify conservative management. Intestinal obstruction, however, may be a serious complication; hence, in an effort to avoid it, periodic re-examinations are justified. Segmental resection of portions of the bowel most involved does not insure a cure. Other lesions may become more extensive after such resections [*24*]. When the rectum is affected it should be spared because rectal lesions usually disappear after resection of a more proximal diseased segment of the colon.

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Lumbar Sympathectomy for Peripheral Arteriosclerosis

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IN 1952, we completed and published a report of a study of our results of lumbar sympathectomy in the treatment of peripheral arteriosclerosis. It appeared desirable at this time to compare the results of two groups of patients treated by this method for this type of peripheral vascular insufficiency. This study, therefore, compares the findings and results of our original group, Group A (patients operated upon from October, 1946 to December, 1951) and the latest group, Group B (patients operated upon from January, 1952 to December, 1955).

TABLE I
AGE GROUPS

Groups	Incidence by Decades				
	41–50	51–60	61–70	71–80	Over 81
A (49)	1 (2.5%)	26 (54%)	18 (34%)	3 (7%)	1 (2.5%)
B (66)	1 (1.5%)	29 (44%)	32 (48.5%)	3 (4.5%)	1 (1.5%)

During the years 1946 to about 1953, many favorable reports appeared in the literature concerning the value of lumbar sympathectomy. However, since that time, several reports have not been too favorable. It is our purpose, then, to present our current findings with those of a former series and thereby give a more realistic status of this procedure in the management of arterial insufficiency due to arteriosclerosis.

The basic feature of this operation is entirely predicated upon the thesis that it provides for release of the associated vasospasm of the vascular channels, and particularly of the large vascular bed. Also, this release of spasm will permit the unaffected collateral channels to develop to their fullest extent. This elastic potentiality is more fully appreciated by those surgeons with a broad experience in the surgical management of peripheral vascular diseases. The beneficial effects of this improvement in circulation is noted by diminution or elimination of pain, increased warmth and dryness to the affected extremity, a more rapid healing of ulcers, reduction in edema and control of cellulitis. A more conservative attitude toward amputation, when it becomes necessary, can be safely practiced.

Sympathectomy does not modify the local pathologic changes or the normal progress of the disease. It does, however, improve circulation by the releasing of the associated vasospasm and permitting for the more adequate development of unaffected collateral channels.

COMPARATIVE FACTORS

This survey involves Group A—forty-nine (twenty diabetics) male patients ranging in age from forty-four to eighty-four years of age. The average age was 59.2 years, the greatest number being in the fifty-one to sixty year age group. (Table I.) Seventy-two lumbar sympathectomies were performed: thirteen on the right, the same number on the left and twenty-three were bilateral. (Table II.)

In Group B there were sixty-six (nineteen diabetics) male patients ranging in age from forty-nine to eighty-five years of age. The average was 61.1 years, the greatest number being in the sixty-one to seventy year age groups. (Table I.) One hundred five sympathectomies were performed: fourteen on the right, thirteen on the left and thirty-nine were bilateral. (Table II.)

The average duration of symptoms in Group A was eighteen months, the shortest one week and the longest twenty years. In forty-five (90 per cent) patients the major complaint was pain. In association with this, twenty-one patients also had cellulitis and twenty-three had chronic ulcers of the leg or foot. In seven cases there was edema of the extremities. In forty-seven patients the peripheral arterial pulse was diminished or absent. (Table III.)

TABLE II
OPERATIONS PERFORMED

Side	Group A (49)	Group B (66)
Right	13 (26.5%)	14 (21.2%)
Left	13 (26.5%)	13 (19.8%)
Bilateral	23* (47%)	39* (59%)
Totals:	72	105

* Double number to get total.

The average duration of symptoms in Group B was twenty-six months; the shortest one week and the longest fifteen years. In forty-six (70 per cent) patients the major and chief complaint was pain. In association with this, nineteen patients also had cellulitis and nineteen had chronic ulcers of the leg or foot. In seven cases there was edema of the extremities. In sixty-three patients a diminished or absent peripheral arterial pulse was noted. (Table III.)

TABLE III
SYMPTOMS AND FINDINGS

Type	Group A (49)	Group B (66)
Pain	45 (92%)	46 (70%)
Ulcer	23 (47%)	19 (29%)
Cellulitis	21 (43%)	19 (29%)
Gangrene	18 (37%)	16 (24%)
Edema	7 (14%)	7 (11%)
Pulse change	47 (97%)	46 (70%)

SURGICAL PROCEDURE

Lumbar sympathectomies in the majority of cases were performed under spinal anesthesia, using a transverse mid-abdominal, muscle-splitting incision at the level of the umbilicus. The approach was extraperitoneal through a muscle-splitting incision. The sympathetic ganglionated chain was removed from below the first lumbar ganglion to below the fourth. A variety of patterns as to size, number of ganglia present and branches originating from this portion of the chain were seen. Therefore, it is incumbent upon the surgeon to be familiar with these variations and to remove all sympathetic fibers in this area in order to obtain optimum results. The wounds were closed in layers using silk sutures throughout. The patients were ambulatory on the first postoperative day.

TABLE IV
POSTOPERATIVE COMPLICATIONS

Type	Group A (49)	Group B (66)
Atelectasis	..	1
Cerebrovascular accident	1	..
Embolus, right leg	1	..
Embolus, pulmonary	1	..
Ileus, paralytic	3	2
Neuritis, anterior thigh	1	..
Phlebitis	2	..
Pneumonia	..	1
Wound:		
Infection	1	..
Hematoma	1	4
Totals:	11	8

RESULTS

Postoperative complications developed in eleven (22.4 per cent) patients in Group A and in eight (6.8 per cent) patients in Group B. The types are listed in Table IV.

There was one postoperative death (2 per cent) in Group A and none in Group B. The death occurred in a fifty-nine year old man on the second postoperative day; it was due to pulmonary embolism.

Amputations were performed following sympathectomy in fourteen of the patients in Group A who had gangrene of the toes or foot. Thirteen of these required major amputations. In six (44 per cent) of these cases (one bilateral) the amputations were accomplished above the knee, and in seven (two bilateral) the amputations were below the knee. In the latter group five of the amputations were through the upper or middle third of the leg, and in two, transmetatarsal amputations were performed. Local amputation of gangrenous toes was accom-

plished in one patient. In 21 per cent the amputation was of a type which did not require a prosthesis; the patient had a good functional limb. In the patients who required an amputation above the knee because of extensive gangrene and/or poor circulation due to extensive

TABLE V
AMPUTATIONS PERFORMED

Type	Group A (23%)	Group B (25%)
Above knee.....	6 (44%)	7 (41%)
Below knee.....	5 (35%)	6 (35%)
Transmetatarsal.	2 (14%)	2 (12%)
Toes.....	1 (7%)	2 (12%)
Totals:.....	14	17

damage to the main vascular channel, the rapid healing of the stump appeared to be influenced by previous satisfactory sympathectomy. (Table v.)

Amputations were performed following sympathectomy in seventeen (25 per cent) of the patients in Group B with gangrene of the toes or foot. Thirteen of these required major amputations. In seven (41 per cent) the amputations were performed above the knee (two bilateral), and in six (35 per cent) patients amputations were performed below the knee (two bilateral). In two patients transmetatarsal amputations were performed, and in two others only the involved toes were amputated. (Table v.) In 23 per cent the amputation was of a type which did not require a prosthesis. The same statement made in Group A pertains to this group also.

The postoperative follow-up evaluation indicated the results were good in thirty (61 per cent), fair in thirteen (26 per cent) and poor in six (13 per cent) patients in Group A, and good in forty-one (62 per cent), fair in thirteen (20 per cent) and poor in twelve (18 per cent) in Group B. (Table VI.)

COMMENTS

As a result of this comparative survey of our two groups, it is readily apparent that the aging population of the type patient entitled to treatment at this hospital has increased the number of patients treated for this disease With the average age slightly higher in Group B, the combined groups, therefore, showed a greater number over sixty years of age (50 per cent) than in our original report.

Since the morbidity and mortality rates are very low, as indicated by this combined series, the benefits accrued outweigh any of the surgical risks, providing there are no other major

TABLE VI
EVALUATION OF RESULTS

Type	Group A	Group B
Good.....	30 (61%)	41 (62%)
Fair.....	13 (26%)	13 (20%)
Poor.....	6 (13%)	12 (18%)
Totals:.....	49	66

conditions which contraindicate major surgery. The favorable results are apparent shortly after surgery, and in many the improvement in circulation may continue for many months thereafter. These delayed beneficial effects probably can be explained on the time required for the collateral channels to develop to their fullest extent.

Any slight increase of the arterial supply to an extremity or digit appears to bring considerable relief in pain and enhances the healing power of the local tissues, thereby aiding in rapid improvement of local infections and cellulitis. Improvement of circulation is evidenced by warming of the extremity and dryness of the skin.

SUMMARY

The results of lumbar sympathectomy in the treatment of peripheral arteriosclerotic vascular disease of the lower extremities (including diabetics) in two consecutive series of cases are compared. In Group A there were forty-nine males upon whom seventy-two sympathectomies were performed from 1946 to 1951; in Group B there were sixty-six males upon whom 105 sympathectomies were performed from 1952 to 1955.

The patients in both groups were in the forty-four to eighty-five year age range with the largest number (90 per cent) in the fifty-one to seventy year age group.

Improvement was experienced in about equal numbers in both Groups A and B, being 86 and 82 per cent, respectively.

In 61 per cent of patients in Group A and 69 per cent in Group B who required an amputation, it was accomplished below the knees.

The performance of this procedure, as evidenced by the over-all favorable results with about the same frequency in both groups in properly selected patients, continues to be an important method of management of selected patients with peripheral arteriosclerosis on our services. The results are most favorable in the group who exhibit associated vasospasm and a vascular bed which has elastic potentialities; these are evident by the results such as diminution or relief of pain, increased walking distance without pain or discomfort, warmth and dryness of the extremity, more rapid healing of ulcers, subsidence of infection or cellulitis and improvement in edema. In addition, when a major amputation becomes necessary, it can most often be accomplished at a lower level with safety. In some, this procedure may obviate amputation or delay it. The patient frequently is rehabilitated more rapidly and the period of hospitalization is reduced.

We recommend:

Calderwood's Orthopedic Nursing. Revised by Carroll B. Larson, M.D., F.A.C.S. and Marjorie Gould, R.N., B.S., M.S. Fourth edition, 701 pages, with 307 illustrations. St. Louis, 1957. The C. V. Mosby Co. *Price* $5.75.

Essentials of Clinical Proctology. By Manuel G. Spiesman, M.D., B.S., L.L.D., F.I.C.P., Associate Professor of Proctology, Chicago Medical School, Chicago, Illinois; and Louis Malow, M.D., B.S., F.A.C.S., Associate in Surgery, Chicago Medical School. Third revised edition, 316 pages, with 129 figures (frontispiece in color), a bibliography and an index. New York, 1957. Grune & Stratton, Inc. *Price* $8.75.

Medical Progress 1957. Edited by Morris Fishbein, M.D.; twenty-nine contributors. 367 pages, with references at chapter endings and an index. New York, 1957. McGraw-Hill Book Co. *Price* $6.00. (As would be expected, Dr. Fishbein has done his usual excellent editing.)

A Comparison of Antibiotic Concentrations in Plasma and Muscle

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WOUNDS studied during the recent Korean conflict showed a rich aerobic and anaerobic bacterial flora [*1,2*]. The clostridial organisms isolated from such wounds were subjected to sensitivity studies using penicillin, aureomycin, terramycin® and chloramphenicol [*3*]. The plasma levels of penicillin, after the intramuscular injection of 300,000 and 600,000 units, were inadequate to inhibit the growth of a rather large percentage of clostridia [*4*].

The plasma levels of any particular antibiotic have been found to be higher than their concentration in most tissues which have been studied [*5*]. Since a very large percentage of battle wounds involve skeletal muscle, this study was designed to determine how muscle and plasma levels of the most commonly used antibiotics compared when simultaneous sam-

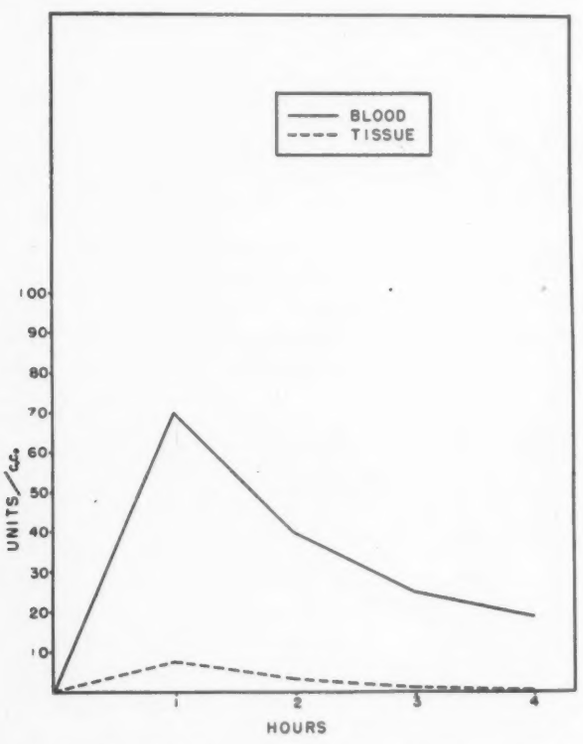

FIG. 1. Blood and tissue levels after injection of 30,000 units/kg. procaine penicillin G intramuscularly. This graph, representing the average of four rabbits studied, demonstrates the low concentration of penicillin in the muscle. It is likely that this reflects the rapid excretion of this antibiotic in the urine.

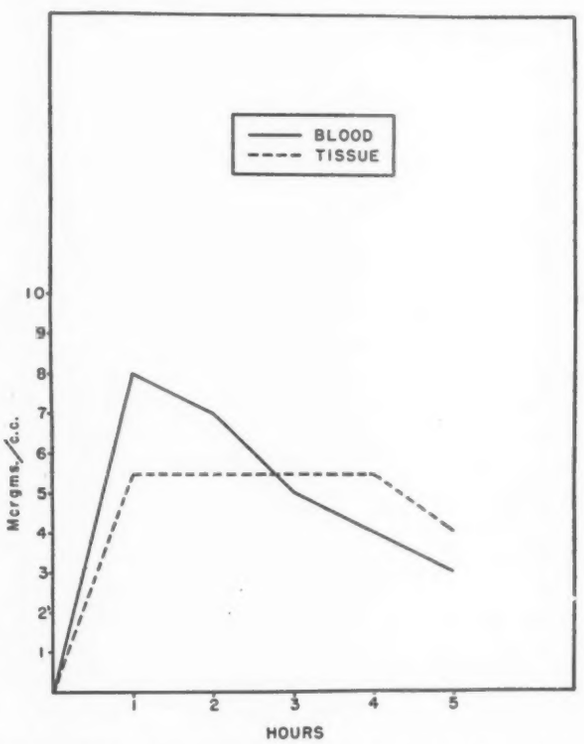

FIG. 2. Blood and tissue levels after injection of 50 mg./kg. aureomycin hydrochloride intravenously. After intravenous injection of aureomycin the tissue levels are relatively high and even exceed the plasma concentrations late in the experiments.

ples were taken. With such information a more precise evaluation of antibiotic prophylaxis and treatment in wound myositis might be made.

MATERIALS AND METHODS

Rabbits averaging 2 kg. in weight were selected as experimental animals. After each rabbit had fasted for twenty-four hours, all four extremities were shaved. The appropriate antibiotic was then given intramuscularly or intravenously. The following large doses were used in order to facilitate analysis: procaine penicillin, 30,000 units/kg. of body weight; aureomycin HCl, 50 mg./kg.; terramycin HCl, 75 mg./kg. and 250 mg./kg.; and chloramphenicol, 250 mg./kg.

Under ether anesthesia, and utilizing a sterile surgical technic, blocks of skeletal muscle were taken from a rabbit's extremity at hourly intervals for four or five hours. Simultaneously, heparinized blood samples were taken and the plasma was separated under sterile precautions. Care was taken not to excise muscle near the site of injection.

Maintaining sterile precautions, each block of excised muscle, weighing approximately 1 gm., was ground in the TenBrock tissue grinder. To each gm. of tissue, 4 cc. of sterile saline solution was added, giving a dilution of 1:5. The suspension was transferred to a 15 cc. centrifuge tube and spun at 1,500 r.p.m. for fifteen minutes. The plasma and the supernate of the tissue suspension were aseptically transferred to sterile test tubes. The plasma was diluted with saline solution to final concentrations of 1:10 and 1:100. Petri dishes, 15 by 150 mm., containing a thin layer of blood agar, were streaked with an eighteen-hour broth culture of Shigella dysentariae (ES110) for chloramphenicol and terramycin sensitivities, and hemolytic staphylococcus (Heatly strain) for the penicillin and aureomycin sensitivities. Nine stainless steel cylinders, measuring 10 mm. in height with a 10 mm. inside diameter, were placed on the surface of the plate in three rows: 0.5 ml. amounts of undiluted 1:10 and 1:100 plasma, respectively, were placed in the upper row cups; 0.5 ml. amounts of saline solution containing 100, 10 and 1 μg. respec-

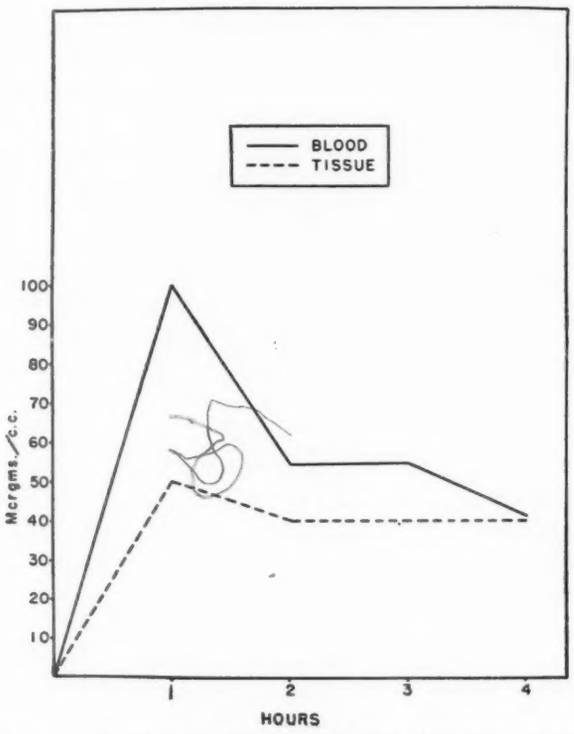

FIG. 3. Blood and tissue levels after injection of 75 mg./kg. terramycin hydrochloride intravenously. Terramycin levels in muscle reach about two-thirds of the plasma concentration after intravenous injection.

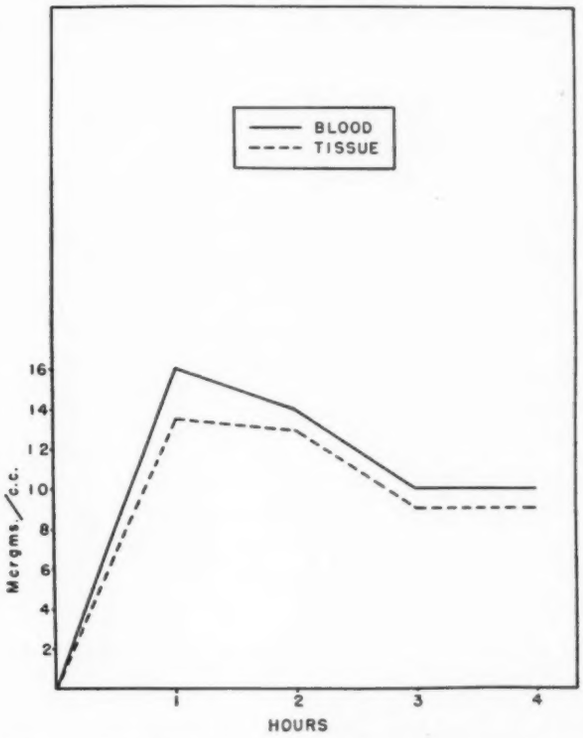

FIG. 4. Blood and tissue levels after injection of 250 mg./kg. terramycin hydrochloride intramuscularly. Terramycin levels in muscle rose to 90 per cent of the plasma concentration after intramuscular injection.

tively, of the antibiotic standard were placed in the center row as controls; and 0.5 ml. amounts of 1:5, 1:10 and 1:100, respectively, of the diluted tissue extract were placed in the lower row. The Petri dishes were then incubated at 37°c. for eighteen hours, after which

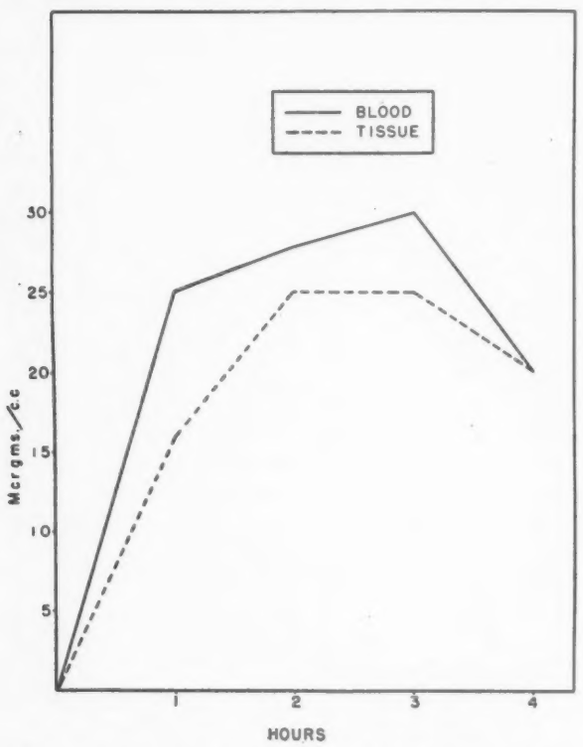

FIG. 5. Blood and tissue levels after injection of 250 mg./kg. chloramphenicol intramuscularly. This graph demonstrates the close approximation of the muscle and plasma concentrations of chloramphenicol following its intramuscular injection.

time the zones of inhibition were measured and compared using the graph method.

Four animals were studied in each series.

RESULTS

The average hourly antibiotic levels in blood and tissue of each determination on the four rabbits studied with each antibiotic are demonstrated in Figures 1 to 5.

Penicillin. Following the intramuscular injection of penicillin, the tissue levels during the first and second hours after injection were approximately one-tenth the plasma level. (Fig. 1.)

Aureomycin. The intravenous injection of aureomycin resulted in a tissue level which was approximately 70 per cent of the plasma level at one hour, 80 per cent of the plasma level at two hours, and then equaled or surpassed the plasma concentration. (Fig. 2.)

Terramycin. The intravenous injection of terramycin (75 mg./kg.) resulted in an immediate increase in the serum concentration so that at one hour the serum to muscle ratio was 2:1. Thereafter the serum concentration rapidly fell, whereas the tissue concentration remained almost constant. (Fig. 3.) Following the intramuscular injection of terramycin (250 mg./kg.), the muscle concentration rose to two-thirds of the plasma concentration and remained at this relative level throughout the four-hour period of study. (Fig. 4.)

Chloramphenicol. Chloramphenicol intramuscularly resulted in a muscle concentration of the antibiotic which ranged between 60 and 90 per cent of the plasma concentration for the first three hours and equaled the plasma concentration at the fourth hour. (Fig. 5.)

COMMENTS

Eagle [6] has pointed out that the concentration of an antibiotic at the focus of infection is the important therapeutic consideration, and the plasma level is of significance insofar as it provides a measure of that tissue concentration. According to Welch and others [7] the plasma concentration should be maintained from two to ten times higher than the estimated need at the focal site. Penicillin is rapidly excreted in the urine [8] and this is probably the explanation of its low concentration in muscle. The assays carried out in this study were performed on rabbits with healthy muscle which had not been previously traumatized by injury or infection. It is probable that the inflammatory response would result in a higher concentration of antibiotics in injured muscle [5,9].

Nevertheless, the rapid excretion and low muscle concentration of penicillin again raises the question of the adequacy of this antibiotic in the treatment of combat casualties. The question becomes more acute when the possibility of mass casualties from atomic warfare is considered. Under such conditions, débridement might have to be postponed indefinitely and the role of antibiotic therapy would assume great importance.

SUMMARY

Plasma and muscle levels of various antibiotics were compared at hourly intervals after

administration in rabbits. The levels of aureomycin, chloramphenicol and terramycin in muscle were found to be approximately two-thirds of the plasma levels. The penicillin levels in muscle were less than one-third of the plasma levels.

Acknowledgment: The authors wish to thank Lt. Col. Oscar Felsenfeld and Dr. John M. Howard for their encouragement and advice.

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Surgical Technic of Tracheal Fenestration*

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TRACHEAL fenestration is a surgically created opening into the cervical trachea which is connected with the anterior cutaneous surface of the neck via a skin tube. The outer end of this skin tube is equipped with two door-like skin valves.

The experimental evolution of tracheal fenestration in dogs has been previously reported [*1*]. The purpose of this communication is to present the procedure in its completed form with step by step illustrative sketches.

A 4 to 5 inch long transverse skin incision is made over the anterior aspect of the mid-third of the neck. The incision is extended in such a manner that one skin flap is outlined above, and one below, the initial transverse incision. The skin flaps extend about 1½ inches in transverse direction beyond the midline. (Fig. 1.) Through the original transverse incision the platysma is incised in a transverse direction to about ½ inch distant to the right and left of the midline. (Figs. 1 and 2.) The trachea is then exposed by splitting the strap muscles. (Fig. 3.) A 1¼ cm. length of two neighboring tracheal cartilages are excised with the underlying mucosa. (Figs. 4 and 5.) The tracheal window edges are covered with inverted full-thickness skin. At the right and left sides of the tracheal opening this is accomplished by inverting the distal margin of each of the skin flaps and fixing them to the tracheal mucosa with interrupted through and through figure-of-8 sutures of No. 0 silk. (Figs. 6 and 7.) The upper and lower margins of the tracheal window are covered by inverting the angle of the upper and inferior triangular skin surfaces with through and through figure-of-8 sutures of No. 0 silk. (Fig. 8.) The skin flaps are doubled without dissecting them from the underlying subcutaneous tissue layer. (Figs. 9 and 10.) The approximated edges of the doubled skin flaps are kept together with interrupted No. 000 silk sutures, forming a door-like skin valve on the right as well as on the left side of the outer aperture of the skin tube leading to the tracheal opening. (Figs. 11 and 12.) The residual wound surface is eliminated by approximating the remaining skin edges with interrupted No. 000 silk sutures. In a few instances the door-like skin valves were not in full opposition by the time complete wound healing had taken place. In such a situation a 1½ to 2 inch long perpendicular skin incision was made parallel with, and about 1 inch distant from, the base (Fig. 13) of the valve on each side. These incisions then were closed transversely, which brought the skin valves into an air-tight opposing position. (Fig. 14.)

In light of the difficulties encountered when

* The idea for the need of a procedure such as tracheal fenestration was initially conceived by Drs. Edgar Mayer and Israel Rappaport for the management of advanced inoperable pulmonary suppuration in order to eliminate certain disadvantages of conventional tracheostomy. Their encouragement and constant advice led to the evolution of the surgical procedure described herein.

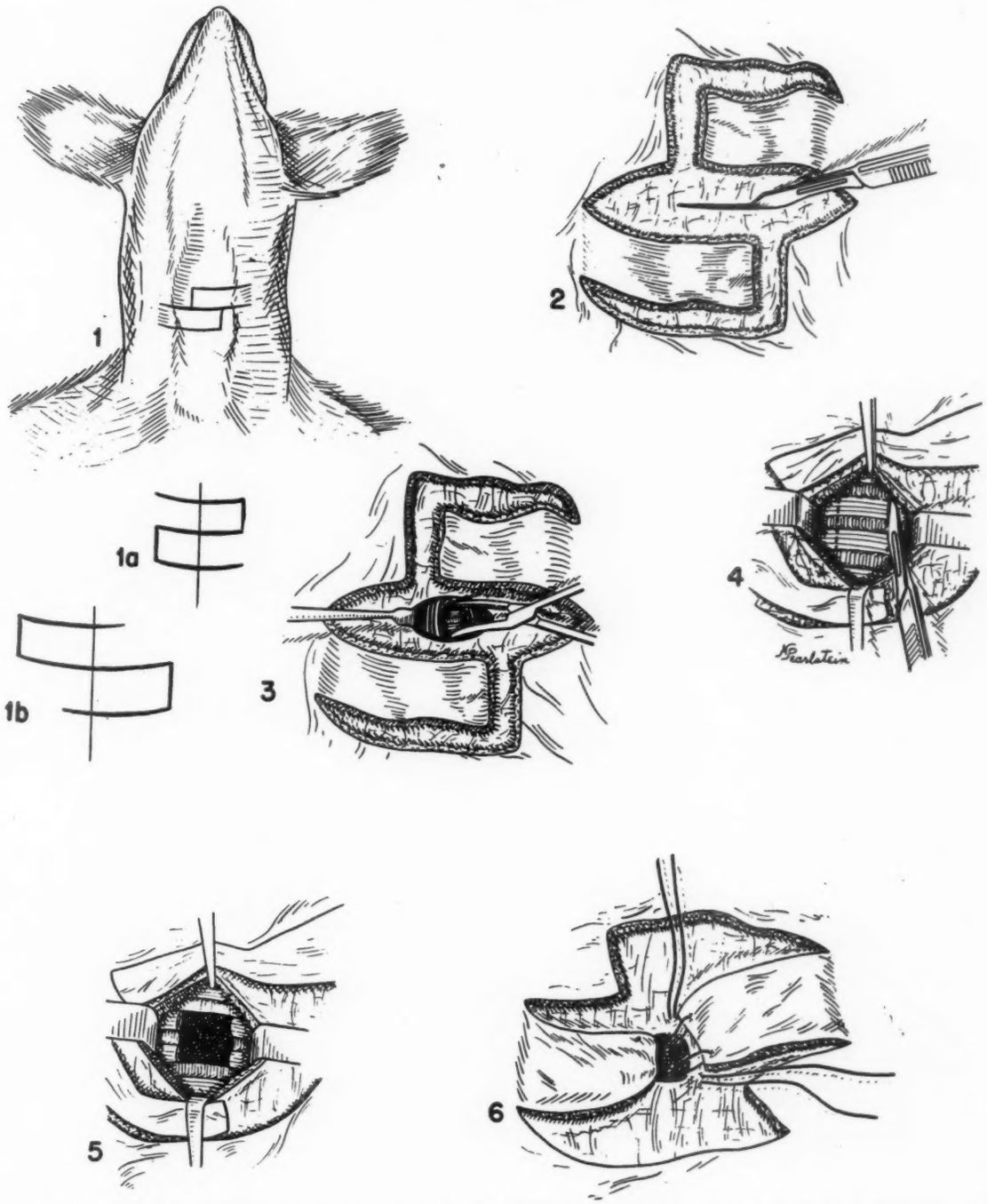

FIG. 1. The initial incision is shown with the opposing skin flaps. A and B, in operation No. 5 (human type) the initial incision is made in such a way that the base of each of the opposing skin flaps is brought nearer to the midline. This eliminates the upper and lower triangular skin surfaces.

FIG. 2. The skin incisions are deepened and the platysma is incised in a transverse direction.

FIG. 3. The trachea is exposed by splitting the strap muscles.

FIG. 4. A window is outlined in the cervical trachea.

FIG. 5. A 1¼ cm. length of two neighboring tracheal cartilages with the underlying mucosa is excised.

FIG. 6. The distal margin of the right skin flap is inverted, and the distal margin of the left skin flap is about to be inverted with two interrupted through and through figure-of-8 sutures of No. 0 silk.

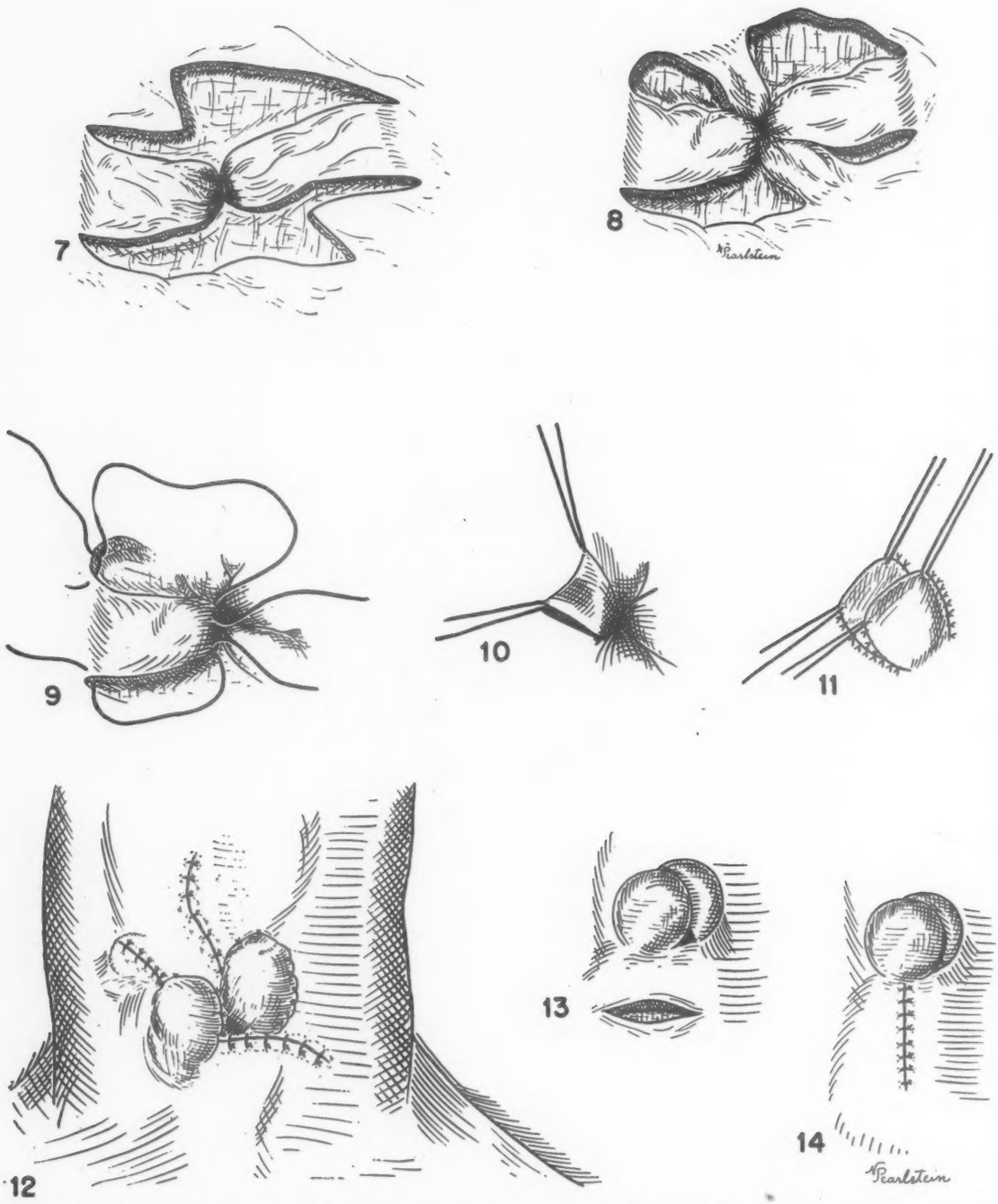

FIG. 7. The distal margins of the skin flaps are inverted (to cover the right and left margins of the tracheal window) with interrupted through and through figure-of-8 sutures of No. 0 silk.

FIG. 8. The upper and lower margins of the tracheal window are covered by inverting the angle of the upper and inferior triangular skin surfaces with through and through figure-of-8 sutures of No. 0 silk.

FIGS. 9 and 10. The skin flaps are doubled without dissecting them from the underlying subcutaneous tissue layer.

FIGS. 11 and 12. The edges of the doubled skin flaps are kept together with interrupted No. 000 silk sutures. The residual wound surface is eliminated by approximating the remaining skin edges with interrupted No. 000 silk sutures.

FIGS. 13 and 14. In case the skin valves are not in full opposition, a 1½ to 2 inch long perpendicular skin incision is made parallel with and about 1 inch distant from the base of the valve on each side. These incisions are closed transversely, which brings the skin valves into an air-tight opposing position.

the first tracheal fenestration was performed on a patient at Metropolitan Hospital, New York City, on January 30, 1956, further animal experimentation was undertaken. These experiments led to the development of Operation No. 5, which is the type of tracheal fenestration now applied to patients. The base of each of the opposing skin flaps was brought nearer to the midline. (Figs. 1A and 1B.) With this initial incision, the upper and lower triangular skin surfaces were eliminated. The distal margin of each of the opposing skin flaps covered not one but two of the four tracheal window edges. The left flap covered the left and lower margins, and the right flap, the right and upper margins of the window. Such a fenestration was then performed, for the first time, on a middle-aged man at Metropolitan Hospital, on April 5, 1956. The second fenestration of this type was performed at Flower and Fifth Avenue Hospitals on a child on June 22, 1956. These experiences will be the subject of a future report.

COMMENTS

Tracheal fenestration provides a communication between the cutaneous surface and the lumen of the cervical trachea, and offers important advantages over conventional tracheostomy. It has no wound surface, thus avoiding the necessity of keeping its walls apart by cannula to prevent obliteration. It does not interfere with phonation because the surgically created opening is closed at all times, unless the door-like skin valves are held apart. For the same reason, it does not affect the cough mechanism. These are important features, particularly since tracheal fenestration is recommended when such a communication needs to be maintained for a prolonged period or even forever. The feasibility of easy insertion of a catheter through the fenestration suggests its therapeutic possibilities in suppurative diseases of the lung. The advantage of effortless elimination of the drainage is obvious in patients with advanced pulmonary suppuration who are not candidates for excisional surgery and who are unable to perform postural drainage. The repeated daily catheter suctioning of the bronchial tree as well as instillation of drugs through the same route may prove to be of particular value in the management of children with pulmonary manifestations of fibrocystic disease of the pancreas.

SUMMARY

The surgical technic of tracheal fenestration, with step by step illustrative sketches, is presented. Clinical possibilities for the use of this procedure are suggested.

Acknowledgment: Grateful acknowledgment is herewith made to the Northwoods Foundation for the main financial support of this work.

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Umbilical Transplantation Upward and Abdominal Contouring in Lipectomy

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FLACCID, pendulous abdominal skin frequently follows weight reduction. Its discomfort and difficulty of hygiene often require relief by primary lipectomy. Incidental lipectomy may also be of advantage when abdominal surgery is performed upon the obese patient. For incisional hernia lipectomy is necessary for an ideal result. The loose skin flows wherever gravity pulls it when the patient turns over. The integrity of the herniorrhaphy is protected by removal of this skin.

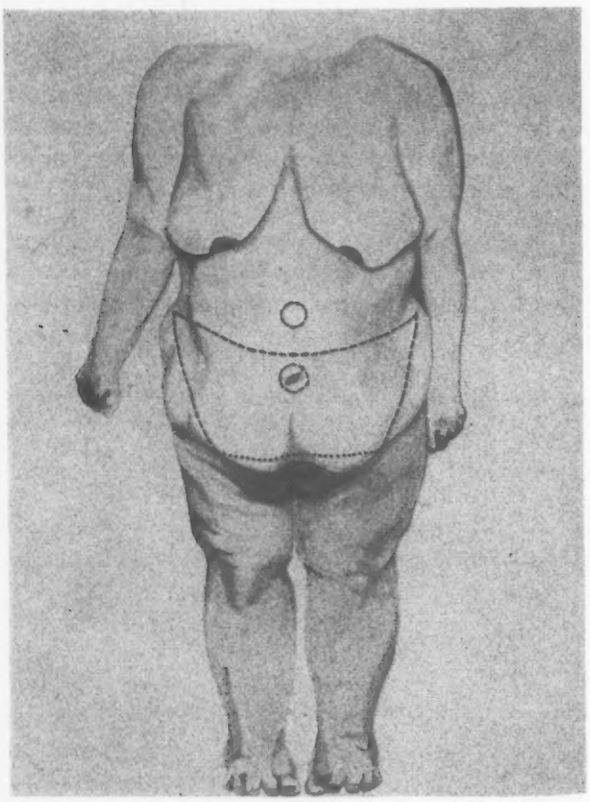

FIG. 1. Extent of excision: Broken line shows incision on anterior side of prolapsus, dotted line on posterior side. Lower circle shows circumcision of umbilicus. Upper circle shows site to which umbilicus is transplanted.

The abdominal apron hangs below the symphysis pubis and has a reflecting portion facing backward. The posterior layer, in contact with the pubis and thighs, may develop a raw appearance, and hot weather aggravates the difficulties of hygiene. The deformity includes a downward displacement of the umbilicus. Also, the down-slippage of skin produces a truncated cone, the skin of the upper abdomen being stretched downward and the anterior arc of the lower abdominal circumference increased.

The procedure described herein illustrates desirable management of the umbilicus. Sacrifice of the umbilicus by surgery should be avoided, since emotional changes have been observed. Cosmetic considerations should be respected, for dislocation of the umbilicus downward with lipectomy leaves a grotesque appearance.

TECHNIC

Before operation, in order to arrive at the desired extent of excision, the prolapsed skin is studied while the patient is standing. (Fig. 1.) At operation, with the patient recumbent, the surgeon lifts the abdominal apron upward to judge the desirable upper and lower limits of excision, pressing together the skin which will come edge to edge. (Fig. 2.) Judgment and performance must be unhurried.

The final removal of tissue is a crescentic portion of abdominal panniculus, and it is usually found that the umbilicus lies within the proposed area of excision. A sweeping arc of incision is made along the upper border of the proposed area of excision, extending upward toward the flanks. A longer incision (with a

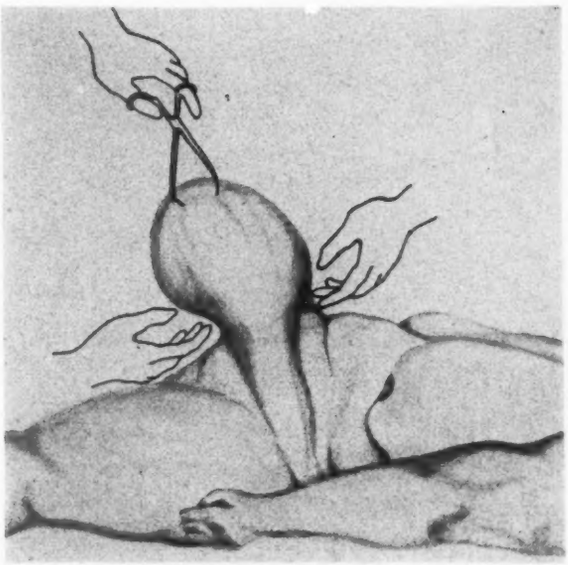

FIG. 2. Recumbent patient on level operating table. Prolapsed panniculus is lifted to judge the ideal amount of excision. While the assistant lifts upward, the surgeon presses together skin which will be in apposition at completion of the operation.

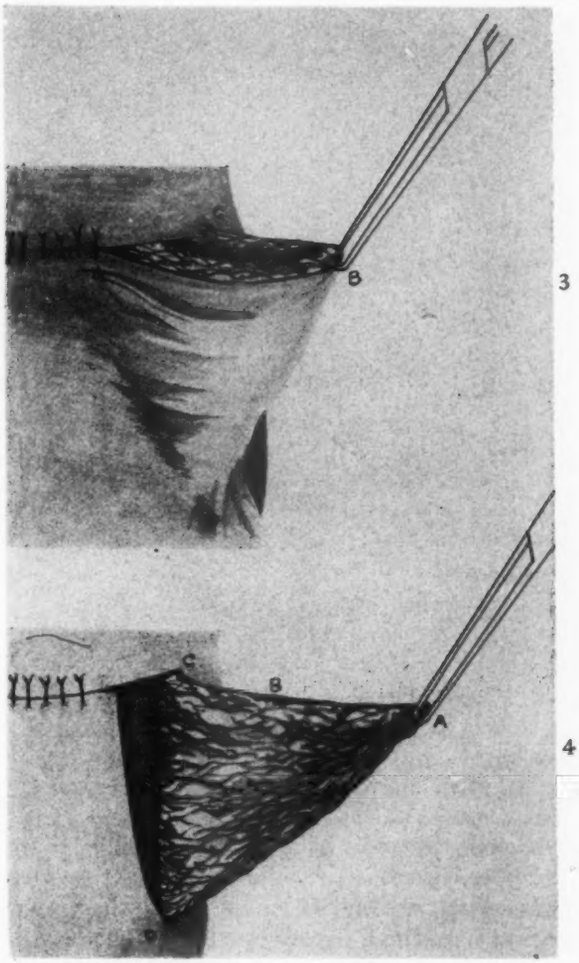

FIG. 3. Removal of dog ears: Clamp at B draws dog ear into a double triangle.

FIG. 4. After incising AD, tissue is held on the stretch to incise CD.

shorter radius of curvature) is made along the lower edge. The umbilicus is circumcised and the fat around it bluntly dissected to the anterior rectus sheath. (If a hernia or other operation has been a part of the procedure, the anterior rectus sheath may have been dissected clean. If a simple lipectomy is being performed, dissection to expose and clean the sheath may result in greater bleeding without improving the result sufficiently to warrant it.)

The point to which the umbilicus is to be transplanted upward is located. The midline is judged by the pubis and ensiform. Care is taken to keep the table level; traction to either side may lead to misjudgment of the midline. The abdominal skin will tend to droop downward when the patient stands again, for which allowance can be made. The size of skin button excised to make way for the umbilicus should be 1 inch or more in diameter; a large umbilicus is easier to keep clean. After removing the button of skin, a new channel is dissected to the rectus sheath toward the base of the umbilicus already separated by previous dissection. A suture is placed at the upper edge of umbilical skin cuff and left long. With this suture the umbilicus is drawn upward through its new channel. The same suture is used to secure the umbilicus to the upper edge of the circle of skin. Twisting is thus avoided and additional sutures uniting the umbilicus to the surrounding skin are placed at the lower end and both sides of the circle. The quadrants may be sewed, using a continuous interlocking suture for each or interrupted sutures.

Dissection of the skin and fat are continued and the tissue composing the abdominal apron is removed. A suture is placed in the midline apposing the skin edges. Mattress sutures of steel wire are used for tension, placing gauze between the skin and the wire. Additional sutures are placed laterally from the midline, and on approaching the ends of the incision redundant tissue is found on each side. Additional excision is done to remove redundancies which would appear as "dog ears." The plastic technic to prevent dog ears accomplishes a smoothly contoured abdomen.

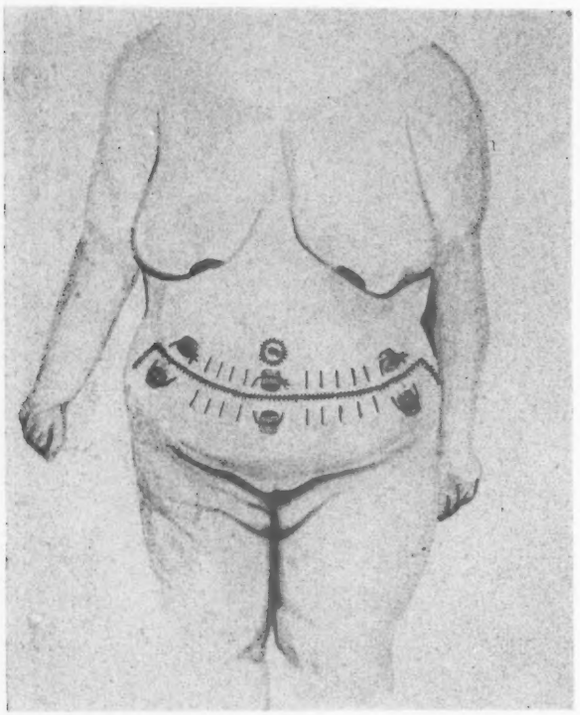

FIG. 5. Final closure: Downpointing lateral limbs of incision after smooth contour is obtained by removal of dog ear. The umbilicus is transplanted upward.

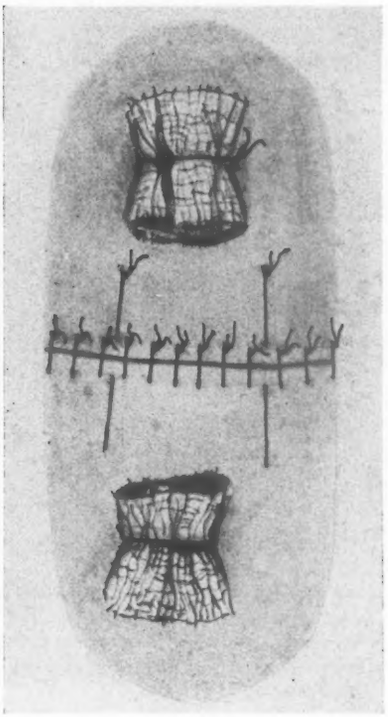

FIG. 6. Close-up of three types of sutures used.

Because the lower edge incision is longer than the upper, tissue is left over on each end as the edges are approximated. As the end of the upper incision is reached, the lower edge is pulled hard up and out into the angle to fit equal lengths of wound edge together. (Fig. 3.) The redundant dog ear becomes evident with traction; and when it is excised on each side, the appearance of the final incision will be almost horizontal, about 3 inches below the new umbilicus, with additional limbs on each side extending downward and posteriorly. These downward limbs are made by excising the dog ears.

The unused remainder of the lower skin edge is grasped at its middle, tenting it up. If there is sufficient tension on this pull, the operator judges correctly where to excise without having to trim again. A dog ear under tension makes a double triangle of skin, the base of which follows the body contour. Of the two other sides, one is open incision and the other is intact skin. Incision of the base from the angle of open incision downward to the other angle excises one portion of the double triangle. (Fig. 4.) Again holding the remaining triangle under tension, incision is made along its base, removing the entire dog ear. This produces the downward projecting limb of the incision, which is approximated with interrupted sutures.

Three types of sutures are used: The steel mattress tension suture may remain twelve days if there are no pressure effects. Second, the vertical mattress sutures of heavy silk function also as tension sutures, but some of these are removed about the fifth day because they contribute to postoperative discomfort if they cut through the skin. The numerous simple edge-to-edge sutures of light silk may be taken out at from four to fourteen days, removing first those that may have been tied tightly. (Figs. 5 and 6.)

COMMENT

Lipectomy is indicated as a primary procedure for pendulus abdomen after weight reduction or as an adjunct to abdominal surgery in obese patients. A technic for relocation of the umbilicus and smooth contouring of the abdomen at the lateral ends of the excision is described.

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Extramammary Paget's Disease

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IN 1874 Sir James Paget [*1*] described the clinical features of the peculiar affection of the areola which bears his name, although he was unaware of the nature or morphologic characteristics of the lesion. In all of the patients overt mammary carcinoma in the underlying breast substance subsequently developed. Because of this sequence of events he believed the latter to be induced by the cutaneous disease. It appears unnecessary to review the controversy which ensued concerning the histogenesis of this skin lesion and its relationship to the mammary neoplasm associated with it. Suffice it to note that there is general agreement that Paget's disease of the breast is a form of mammary carcinoma associated with neoplastic cells arranged in clusters or occurring singly within the epidermis of the nipple and areola. Contrary to Paget's original impression, there is little evidence to support the premise that the mammary carcinoma is secondary to the superficial disease. Unequivocal examples of the latter in the absence of such a neoplasm have not been observed. There are many who consider the epidermal lesion to represent intraepithelial metastases from the underlying carcinoma of the breast, a concept first proposed by Jacobaeus [*2*] in 1904 and further elaborated by the excellent studies of Muir [*3*]. On the other hand, another view holds that both the cutaneous and mammary tumors arise independently in these areas.

That a similar condition might occur in extramammary sites was also noted by Paget. In 1937 Weiner [*4*] critically reviewed all of the recorded examples of extramammary Paget's disease and found only fifteen, including a case of his own, which appeared sufficiently documented to be acceptable. Eisenberg and Theurkauf [*5*] found an additional eleven examples up to 1955, and recorded another. In this same year, Whorton and Patterson [*6*] described a carcinoma of the glands of Moll with "Paget cells" in the overlying epidermis of the eyelid, bringing the total number of cases to at least twenty-eight. It is significant that all of the acceptable cases have occurred in areas where apocrine glands or their modifications are found, particularly the anogenital and axillary regions. The morphogenetic similarity between these latter and the mammary glands is well recognized. It would appear, therefore, that if any connotation between the extramammary and mammary forms of Paget's disease is made, the former should consist of a carcinoma of sweat glands with associated epidermal changes identical to those encountered in the areola of the breast in the mammary disease. It does not appear valid, as emphasized by others [*5*], to include several of the cases recently reported by Dockerty and Pratt [*7*] and Eversole [*8*] as examples of extramammary Paget's disease, since in the former the primary carcinoma originated in the rectum and in the latter's case from the urinary bladder.

Recently we have encountered an example of extramammary Paget's disease occurring in the perianal skin of a fifty-nine year old white man who succumbed to its widespread metastases. The rarity of such an event, not only in the general group of tumors of the sweat gland

FIG. 1. Section of carcinoma of sweat glands demonstrating alveolated and papillary configuration. Original magnification × 130.

FIG. 2. Section of perianal skin revealing neoplastic duct entering epidermis. "Paget cells" are present at the site of contact and adjacent epidermis. Original magnification × 190.

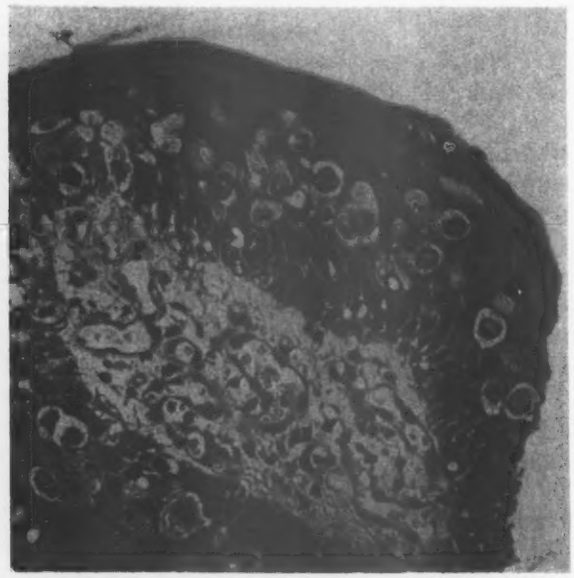

FIG. 3. High power magnification of "Paget cells" within epidermis of perianal skin. Original magnification × 275.

but also particularly those with the features of Paget's disease, appears worthy of note. Further examination of this material has afforded information which appears significant concerning the histogenesis of the epidermal changes encountered in this disease.

CASE REPORT

The patient, a fifty-nine year old white man, was first observed two and a half years prior to death because of anal pruritus of six months' duration. Examination at that time revealed marked excoriation of the perianal skin and an underlying, firm, fixed, irregular mass measuring approximately 5 cm. Superficial inguinal lymph nodes were also palpably enlarged, bilaterally. Proctoscopic examination revealed no abnormalities. A biopsy of the skin and underlying tumor was performed.

On pathologic examination, sections revealed a malignant epithelial neoplasm within the corium and dermal papillae comprised of atypical lumens with occasional papillary invaginations and a moderately dense desmoplastic stroma. (Fig. 1.) The tumor cells were, for the most part, columnar with amphophilic cytoplasms and basally oriented nuclei. The latter were hyperchromatic and moderately pleo-

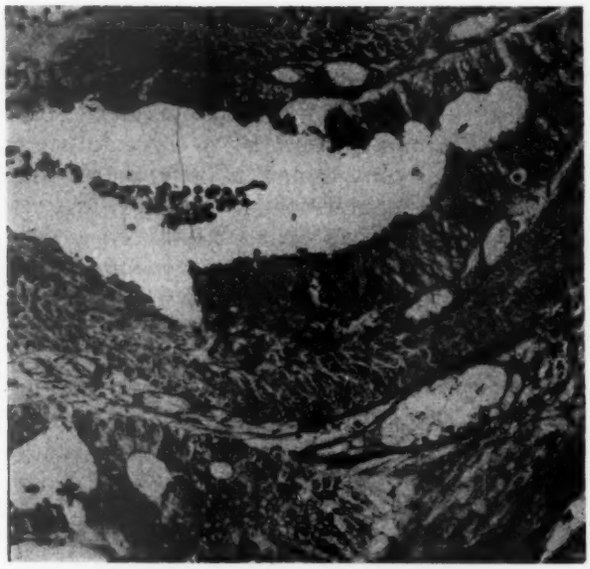

FIG. 4. Section of apocrine carcinoma stained by the periodic acid-Schiff method revealing positively stained (appearing black) droplets in the luminal portion of the cytoplasm of the epithelial cells. Original magnification × 160.

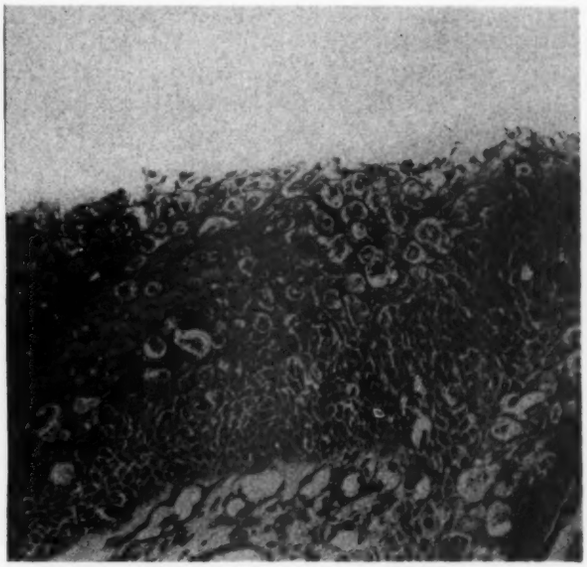

FIG. 5. Section stained by the periodic acid-Schiff method revealing positively stained droplets (appearing black) in "Paget cells."

morphic with prominent nucleoli. Mitoses were infrequent. Many of the neoplastic glands extended to the rete pegs and surface of the epidermis in a duct-like manner reminiscent of the structure of normal sweat glands. (Fig. 2.) The neoplastic cells at the surface of such extensions frequently assumed a round to polygonal configuration. The epidermis revealed focal acanthosis and was thrown into a papillary configuration because of the marked vascularity as well as foci of tumor within the dermal papillae. Distinct, large round to polygonal epithelial cells with clear cytoplasm and large pleomorphic nuclei with prominent nucleoli were noted in the epidermis, being arranged either singly or in small aggregates. (Fig. 3.) Such cells were most frequently observed in the basal layers of the epidermis, particularly at sites where the duct-like extensions of the underlying glandular carcinoma reached this layer. Occasional cells were also observed in the stratum corneum. Occasional mitotic figures were noted in these epidermal cells, although they were devoid of intercellular bridges or evidence of keratinization. Adjacent squamous epithelial cells did not reveal dysplastic change. Sections stained by the periodic acid-Schiff method revealed positive droplets in the cytoplasm of these neoplastic epidermal cells, as well as in many of the adjacent normal-appearing squamous epithelium and tumor cells of the underlying carcinoma. (Figs. 4 and 5.) In the latter, the material was located at the luminal portion of the cell cytoplasm, being identical in this respect to the Schiff-positive material observed in normal apocrine glands. Another similarity between the neoplastic epidermal cells and those of the glandular carcinoma and normal apocrine glands was the resistance to diastase digestion demonstrated by these droplets, indicating that this cellular material was not glycogen. On the other hand, the positive periodic acid-Schiff reaction noted in the unaltered squamous epithelial cells was due to glycogen as evidenced by the lability of the staining reaction to the enzyme.

The diagnosis was extramammary Paget's disease of the perianal skin (adenocarcinoma of apocrine glands with intraepidermal "Paget cells").

Treatment consisted of administration of 5,520 r to the anal and inguinal regions. This resulted in the disappearance of the perianal mass and superficial cutaneous lesion, although the inguinal lymph nodes remained enlarged. An additional 2,000 r was applied in the form of Co^{60} with moderate diminution in their size.

The patient was next observed two years later, at which time he complained of the loss of 40 pounds in weight, weakness, jaundice and back pain. An ulcer measuring 2 cm. in diameter was present at the site of the previous

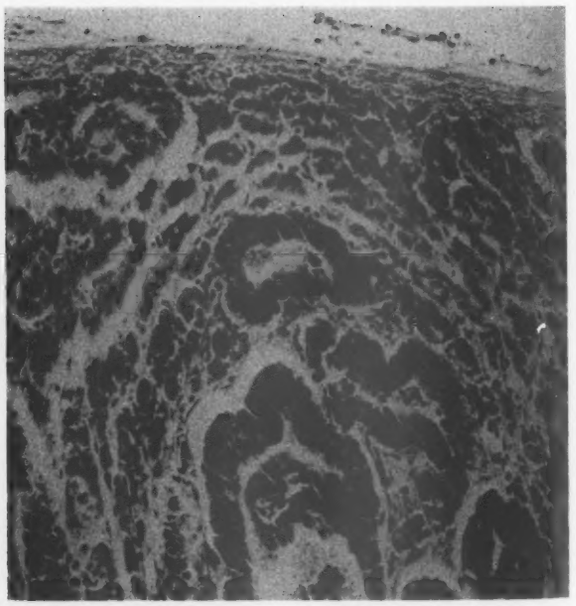

FIG. 6. Section demonstrating metastatic adenocarcinoma in adrenal cortex. Original magnification × 145.

biopsy, and induration of the underlying soft tissue was evident. There was moderate stenosis of the anal orifice, and the inguinal lymph nodes noted previously were large and firm. The liver was palpable several finger-breadths beneath the right costochondral junction and its edge was nodular. An x-ray survey of the skeleton revealed osteolytic areas consistent with metastatic tumor in several thoracic vertebrae. Serum alkaline phosphatase was 35 Bodansky units and a bromsulphalein® test revealed 35 per cent retention in one-half hour. The patient's condition deteriorated rapidly and he died two and a half years after the diagnosis of extramammary Paget's disease of the perianal skin was established.

At necropsy, external examination revealed marked emaciation and jaundice. The skin of the perianal region contained an ulcer measuring 2 cm. in diameter. The underlying soft tissue was indurated, but no distinct tumor could be discerned. Gray, granular tumor nodules with foci of hemorrhage and necrosis characteristic of metastatic carcinoma were observed replacing approximately one-half of the hepatic parenchyma. Similar tumor was noted in the bone marrow of the thoracic and lumbar vertebrae, ribs, both adrenal cortices and inguinal lymph nodes. A diligent search of all organs for a possible primary neoplasm was unrewarding. The gastrointestinal tract revealed no abnormalities except for a small, pedunculated adenomatous polyp in the rectum and moderate stenosis of the anal canal.

Microscopic examination revealed deposits of adenocarcinoma identical to that noted in the biopsy of the perianal skin in the organs and structures enumerated previously (Fig. 6.) Many sections of the perianal skin and underlying tissue revealed inflammatory and actinic changes but no evidence of neoplasm.

COMMENTS

The case presented fulfills the clinical and morphologic criteria of extramammary Paget's disease, namely, a primary carcinoma of sweat glands associated with "Paget cells" in the overlying epidermis resulting in an eczematoid dermatitis. That the glandular carcinoma encountered was derived from the apocrine glands of the perianal skin is strongly suggested by the similarity of its morphologic structure, notably the duct-like extensions to the epidermis and papillary infoldings, to the more common and familiar benign neoplasms of these structures, particularly the syringocystadenoma papilliferum. In addition, the positive periodic acid-Schiff droplets found in the cytoplasm of the tumor cells appeared similar in location as well as nature to the material observed in the epithelium of normal apocrine glands. It appears significant that similar droplets were demonstrated in the tumor cells of the metastatic deposits which also possessed morphologic features identical to the primary growth.

As indicated previously, much of the controversy relating to the histogenesis of the intraepidermal "Paget cells" has been concerned with whether such cells represent a disease *sui generis* of the epidermis or metastases from the underlying carcinomas regularly associated with them. Study of the material in this case allows for an interpretation consistent with the latter. Admittedly, such cells are morphologically indistinguishable from those encountered in Bowen's disease of the skin (primary intraepidermal carcinoma) and in some instances of melanocarcinoma. However, the lack of dysplastic change in the squamous epithelial cells immediately adjacent to the "Paget cells" is unlike that encountered in Bowen's disease, being in this respect similar to the appearance of metastatic deposits in

other sites. It has also been noted that, unlike the unaltered epithelial cells of the epidermis which contain glycogen, these neoplastic cells do not contain this material but do contain a diastase-resistant, periodic acid-Schiff substance similar to that found in the cells of the underlying glandular carcinoma. Lastly, as indicated by Sekiguchi [9] as far back as 1917, the occurrence of such cells at sites where the duct-like extensions of the underlying carcinoma extend to the epidermis suggests their derivation from this neoplasm. That intraepidermal metastases may occur with tumors other than those originating from skin appendages has been noted on previous occasions [7,8,10,11]. The morphologic appearance of the neoplasm in this case precludes the consideration that the intraepithelial neoplastic cells in this case are related to melanocarcinoma.

Analysis of the recorded cases of extramammary Paget's disease tends to refute the contention that the clinical behavior of apocrine neoplasms is invariably benign [12]. Although the disease is frequently of long duration, more than one-half of the reported cases being present for six years or more, regional metastases have not been infrequent. Also, that widespread metastases may result from such tumors is apparent from this report as well as that of Weiner. It is significant that Smith [13], in his recent review of all metastasizing tumors of the sweat glands, found these lesions to represent a rather distinct group. Morphologically, they were characterized by an alveolar structure frequently with papillary projections, and that at least one-third occurred in sites where apocrine glands are normally encountered. Their predominance in females, as well as their clinical course, was similar to those examples of tumors of the sweat glands accompanied by the epidermal changes associated with Paget's disease. Such information suggests that the glandular carcinoma encountered in examples of extramammary Paget's disease is not unique, as has been previously suggested [5] but does form a distinct clinical and pathologic entity when associated with the intraepidermal changes characteristic of Paget's disease.

The aforementioned premise appears of practical significance concerning the therapy of extramammary Paget's disease. Radiotherapy has been of little value in the treatment of other metastasizing tumors of the sweat glands. Little mention has been made of its use in examples of extramammary Paget's disease. It is of interest that in this case scuh therapy resulted in apparently complete regression of the primary disease, but its effect upon the regional metastases was negligible. Since the results in other metastasizing tumors of the sweat glands with regional metastases have been better with surgical excision and regional node dissection, it would appear that such therapy would also be most effective in the treatment of extramammary Paget's disease, which represents an example of carcinoma of the sweat glands associated with intraepidermal metastases.

SUMMARY

A case of extramammary Paget's disease of the perianal skin with widespread metastases in a fifty-nine year old white man is presented. This represents approximately the twenty-ninth recorded example of this disease, and only the second in which widespread metastatic disease has been unequivocally demonstrated.

Analysis of previous examples of extramammary Paget's disease reveals it to represent a primary carcinoma of the sweat glands associated with epidermal changes with cutaneous manifestations similar to those of Paget's disease of the breast. The occurrence of the epidermal involvement represents the only morphologic and clinical feature differentiating this disease from other examples of metastasizing carcinoma of the sweat glands.

Morphologic evidence is presented which indicates that the primary tumor in this case was derived from apocrine glands, and that the so-called "Paget cells" represent its epidermal metastases.

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We recommend:

Principles of Urology. An Introductory Textbook to the Diseases of the Urogenital Tract. By Meredith F. Campbell, M.S., M.D., F.A.C.S., Emeritus Professor of Urology, New York University, New York, New York. 622 pages, 319 figures, with a 6-page bibliography and an index. There are questions on the subject matter in each chapter; excellent for students. Philadelphia, 1957. W. B. Saunders Co. *Price* $9.50. (A solid work by one of the foremost men in his specialty.)

The Treatment of Burns. By Curtis P. Artz, M.D., F.A.C.S., Lt. Col., M.C., U.S.A. (Ret.), presently Associate Professor of Surgery, University of Mississippi Medical Center, Jackson, Mississippi; and Eric Reiss, M.D., American Cancer Society Scholar and Instructor in Medicine, Washington University School of Medicine, St. Louis, Missouri. 250 pages, with 199 illustrations on 105 figures. Illustrations by Burr Bush. Philadelphia, 1957. W. B. Saunders Co. *Price* $7.50.

Bifid Blind-ending Ureter

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A BIFID ureter with one branch ending blindly is one of the rarest of the congenital anomalies found in the urinary tract. Only approximately twenty cases have been reported. The exact number is difficult to ascertain because many cases have been reported as congenital ureteral diverticula. Kretschmer [1], Culp [2], Harlin et al. [3], and Gualberto and de Oliveira [4] have previously recorded cases.

FIG. 1A. Retrograde pyelogram.

We recently encountered the anomaly in a twenty-five year old white man who presented the symptomatology of renal colic.

CASE REPORT

This twenty-five year old white man was admitted to the hospital with a diagnosis of right ureteral calculus. Three days prior to admission he had experienced the sudden onset of aching pain in the right costovertebral angle, accompanied with urinary frequency but no burning or gross hematuria. He had had no fever or chills. There had been no vomiting, diarrhea or constipation except that he had

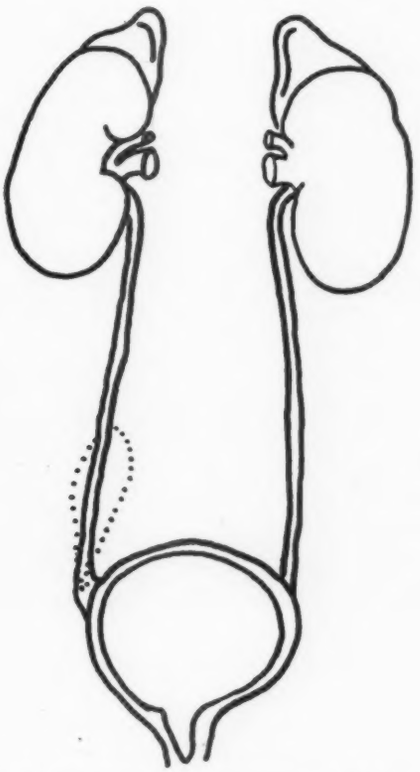

FIG. 1B. Diagrammatic representation of findings on retrograde pyelography.

FIG. 2. Gross surgical specimen.

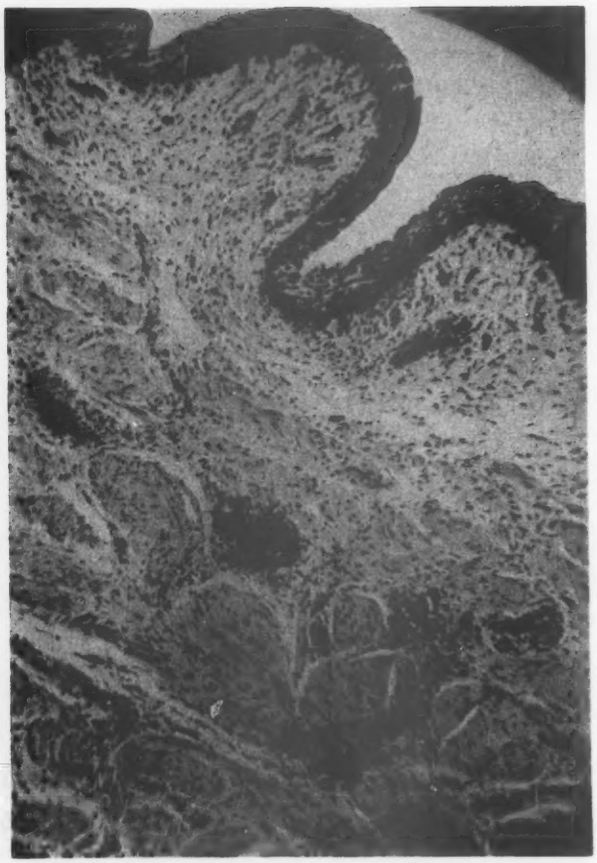

FIG. 3. Microscopic section of wall of blind-ending ureter. Note intact mucosa and muscularis.

had no bowel movement for twenty-four hours preceding admission. He had been slightly nauseated. The evening immediately before admission the pain had become extremely severe and colicky, requiring narcotics.

The systemic review, and personal and family histories revealed nothing of importance.

On physical examination the patient's pulse was 96, respirations 20, temperature 99.4°F. orally and blood pressure 150/90. He had slight discomfort in the right costovertebral angle, radiating to the right lower quadrant of the abdomen. There was slight tenderness in the right costovertebral angle and along the course of the right ureter. No muscle-guarding, rebound pain, masses, hernias or distention was found. Bowel sounds were normal. No free fluid could be demonstrated. A translucent cyst 3.5 cm. in diameter was noted in the upper pole of the right epididymis. The remainder of the physical examination revealed no abnormalities.

Urinalysis revealed: specific gravity, 1.015; reaction, acid; sugar, negative; albumin, 1 plus; also, an occasional white blood cell and many red blood cells were seen on microscopic examination. The blood picture, blood urea nitrogen, sugar, calcium and phosphorus were all normal.

Intravenous pyelography revealed normal-appearing right and left kidneys and left ureter. The lower half of the right ureter, however, could not be seen. No calculi were seen. At cystoscopy the bladder and ureteral orifices were normal. On attempting to catheterize the right ureter a complete obstruction was encountered at 10 cm. Retrograde urography then demonstrated a bifid blind-ending ureter arising approximately 3.5 cm. from the ureteral orifice and measuring 6.5 cm. in length. No calculi were noted and there was no evidence of obstruction to the adjacent ureter. The retrograde catheter had entered the blind-ending branch but the adjacent ureter and the right renal pelvis filled well with radiopaque substance. (Fig. 1A and B.) The left ureter and kidney were normal on retrograde urography performed the following day.

Operation was performed through a "hockey stick" incision in the right lower quadrant of the abdomen. The blind-ending tubular structure was easily located closely adherent to the pelvic portion of the right ureter. It arose from the ureter approximately 2.5 cm. from the bladder wall and had a very narrow neck 0.2 cm. in diameter. The structure arose from the

posterolateral aspect of the ureter and spiraled slightly around the lateral aspect of the ureter, passing proximally. It was easily separated from the ureter by blunt and some sharp dissection from the blind end down to the narrow neck. At this point the structure broke away from the ureter, leaving a minute hole in the ureteral wall which was not sutured. A small ureterotomy was performed well proximal to the site of ureteral bifurcation and a No. 6 ureteral catheter was passed easily into the bladder unobstructed. The catheter was removed, adequate periureteral drainage was provided and the wound was closed in layers. The postoperative course was uneventful.

The pathologic report was as follows: The specimen consisted of a pink, tubular structure 6.5 cm. in length. One end (0.6 cm. in diameter) was closed; the other end was open and measured 0.2 cm. in diameter. (Fig. 2.) When the structure was opened, it was seen to be lined by smooth, glistening mucosa except for a few flecks of focal hemorrhage in the mucosa at the narrow end. The wall measured 0.1 cm. in thickness. The lumen was empty.

Microscopic sections through the wall showed intact transitional cell mucosa, tunica propria mucosae, circular and longitudinal smooth muscle layers and an adventitia composed of areolar connective tissue. There was no evidence of inflammation or malignancy. (Fig. 3.)

COMMENTS

Although many (fourteen) of the reported cases have been described as congenital ureteral diverticula, we agree with Kretschmer and Culp that the bifid blind-ending ureter is a separate entity. It has arbitrarily been defined as a tubular, blind-ending structure with a length at least twice its greatest diameter, joining the ureter at an acute angle and usually by a small stoma. The walls of the structure contain all the normal coats of the ureteral wall. This latter fact differentiates the bifid blind-ending ureter from the acquired ureteral diverticulum (due to obstruction or trauma to the ureter) in which some of the normal layers of the ureteral wall are absent.

The most probable embryologic explanation is that a bifid blind-ending ureter represents an abortive attempt at ureteral reduplication, arising from an accessory ureteral bud of the wolffian duct. It is most often found originating from the pelvic portion of the ureter and may arise from almost any aspect of the circumference.

Since 1921 diagnosis has most often been made by retrograde urography, although occasionally it has been made by intravenous urography or surgery.

Symptoms are usually caused by some complication such as infection, calculus, tumor or stasis of urine in the sac with obstruction to the adjacent ureter. In our case symptoms closely simulated renal colic; but since we found no infection, calculus or tumor in either the ureter or the blind-ending branch, we believe that stasis of urine in the sac with pressure on the adjacent ureter had occurred.

Treatment usually consists of simple removal of the anomalous structure. However, nephroureterectomy conceivably would be necessary in some cases in which there is extensive infection or renal damage if the other kidney and ureter were in satisfactory condition.

SUMMARY

A case of a bifid blind-ending ureter is presented. Symptomatology in this case simulated renal colic. All symptoms ceased following surgical removal of the anomalous structure.

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Neonatal Tumors of the Kidney

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Past experience indicates that the most likely cures for tumors of the kidney in children result in those patients treated in infancy. Thus the primary responsibility of detecting these tumors rests with the obstetrician, the pediatrician or the general practitioner who delivers and attends the infant.

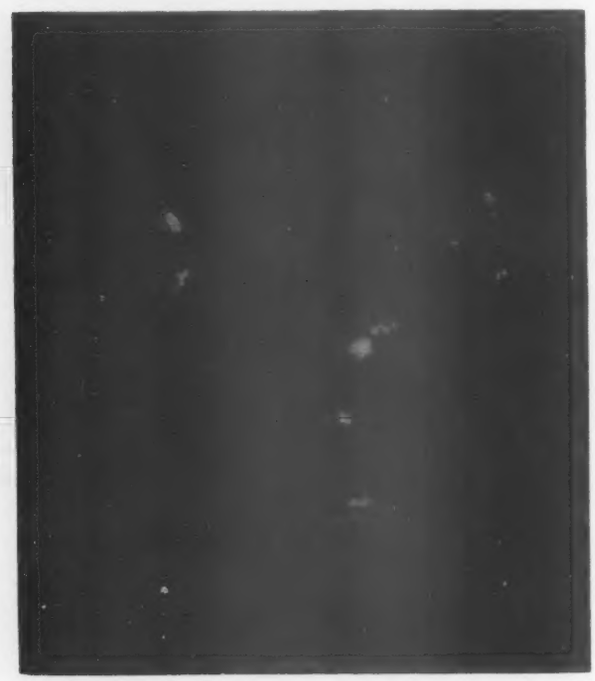

Fig. 1. Polycystic kidney causing lumbar-abdominal mass discovered at birth.

On noting the lumbar-abdominal mass, the differential diagnosis must include suspicions of: (1) Wilms' tumor, (2) neuroblastoma sympatheticum, (3) hypernephroma, (4) unattached retroperitoneal embryoma or teratoma, (5) congenital hydronephrosis, and (6) polycystic kidney. Following thorough physical examination and repeated urinalysis, skeletal and lung x-rays and intravenous or retrograde pyelograms may further help to establish the diagnosis. The continuation of adequate care must include prompt surgical exploration which will confirm the diagnosis and offer the opportunity for definitive cure.

Because there is a natural timidity to subject newborn infants to the major procedure of nephrectomy, it is important to emphasize their amazing ability to withstand radical surgery and to underline again the short period of therapeutic cure these babies are allowed.

The cases reported herein illustrate: (1) the early detection of tumors of the kidney in the infant, (2) the facility of their surgical extirpation, and (3) the uneventful convalescence, including hospital discharge of one infant to the mother's care on the second postoperative day and the other infant on the fourth postoperative day.

CASE REPORTS

Case 1. C. J., a full term white female infant weighing 2,950 gm., was born of a twenty-three year old mother, gravida II, para II, on February 14, 1952, following a normal pregnancy. Postnatal examination by Dr. Frances Love revealed a large, irregular mass in the left flank, extending from the costal margin to the left iliac fossa. The possible diagnosis was explained to the parents and early surgery advised. At this time the mother elected to take the baby home to consider surgery at a later date.

On March 21st the infant was readmitted for definitive treatment. The patient had done well on evaporated milk formula, and physical examination revealed no other abnormalities other than the mass previously mentioned. The tumor had not increased in size, was freely movable and moved with respiration. Repeated urinalysis showed no abnormalities. The hemo-

FIG. 2. Preoperative anteroposterior x-ray of the abdomen showing elevation of diaphragm and displacement of the small bowel.

FIG. 3. Preoperative lateral x-ray of the abdomen showing extreme distention.

globin was 15 gm. per cent, the red blood cell count 4,990,000 per cu. mm., and the white blood cell count 6,500 per cu. mm. with 80 per cent lymphocytes. An intravenous pyelogram failed to visualize the left kidney. The skeleton and lungs were clear.

On March 22nd, when the infant was five and a half weeks old, the tumor was surgically approached under ether anesthesia through the left lumbocostal area. Certainty of the renal origin of the tumor mass made laparotomy unnecessary and the peritoneum was not opened. An obviously non-malignant polycystic kidney was found, mobilized and removed without difficulty. The wound was closed in layers with interrupted silk sutures and without drainage. The operating time was twenty-nine minutes.

The gross specimen (Fig. 1) consisted of a markedly distorted, multicystic kidney measuring 4.5 by 5.5 by 7.5 cm. The external examination revealed no evidence of kidney configuration and no renal parenchyma. The multiple cysts varied from 5.0 cm. in diameter to clusters of smaller cysts, each measuring about 0.5 cm. in diameter. Microscopically the cysts were lined with fibrous tissue or a flattened layer of simple columnar epithelium. The solid tissue showed principally loose fibrous connective tissue.

Postoperatively the infant took water within one hour and formula within three hours. There was no vomiting. The following day the infant passed a small yellow stool, relieving slight abdominal distention. The parents were anxious to care for the infant at their nearby home; and since the temperature, pulse and respirations showed no abnormalities, the child was discharged to her mother's care. The dressing was changed on the seventh postoperative day when the sutures were removed from the clean wound.

CASE II. D. G. (No. 55311), a full term white male infant weighing 4,010 gm., was born of a twenty-four year old mother on May 12, 1954, following a normal first pregnancy. The delivery was difficult because of extreme distention of the baby's abdomen.

Postnatal examination by Dr. E. J. Powers revealed compression of the lungs with incomplete expansion secondary to abdominal distention. Fine rales were audible in all lung fields and the baby was cyanotic and showed circumoral pallor. A tumor mass occupied the entire left side of the abdomen and extended

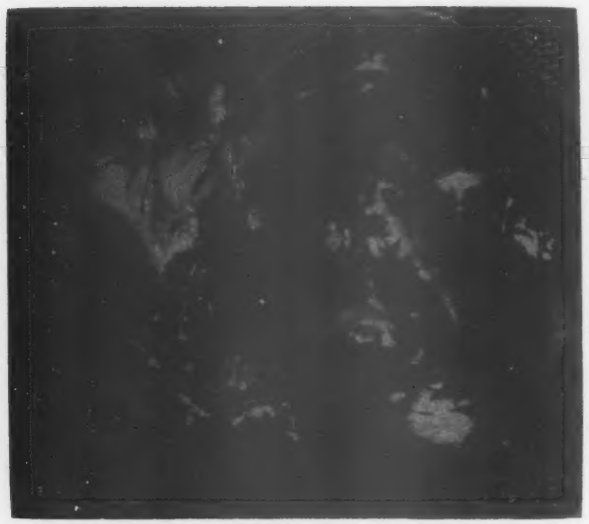

FIG. 4. Gross appearance of the tumor.

FIG. 5. Gross appearance of the tumor after sectioning.

half the distance from the midline to the right lateral abdominal wall. There was dullness to percussion throughout the abdomen except for a tympanitic area along the right lateral gutter. Rectal examination was negative and meconium was present. The abdominal distention was not relieved by gastric suction or passage of a rectal tube, and during the first hour after birth respiratory embarrassment was so severe that emergency decompression of the mass was considered. However, after about an hour of oxygen administration in an incubator the baby's condition improved sufficiently to permit further evaluation and x-ray and laboratory studies.

X-rays of the abdomen (Figs. 2 and 3) revealed a soft tissue mass displacing the entire small bowel to the right lateral gutter. The hemoglobin was 14 gm. per cent, the red blood cell count 4,280,000 per cu. mm., and the white blood cell count 23,600 per cu. mm. with 68 per cent polymorphonuclear leukocytes and 26 per cent lymphocytes.

When the baby was only eight hours old, he underwent surgery and a large cystic tumor of the left kidney was exposed retroperitoneally through a transverse subcostal incision. After the tumor was mobilized and removed without difficulty, the peritoneum was opened to permit abdominal exploration which proved to be negative. The tumor was grossly malignant but was well encapsulated and there was nothing to suggest local extension or distant metastases. The wound was closed in layers without drainage using running No. 000 chromic catgut for the peritoneum and interrupted No. 000 silk for the fascia and skin. A transfusion of 75 cc. of blood was administered during the operation.

The gross specimen (Figs. 4 and 5) consisted of a saccular mass measuring 8.5 by 11.0 cm. and weighing 165 gm. when decompressed. A renal pelvis measuring 5.0 cm. in length was recognizable, but the bulk of the tumor consisted of soft, homogenous tissue with numerous cystic spaces containing clotted blood and urine. The pathologic diagnosis given was Wilms' tumor of the kidney in a newborn, the histologic pattern being that of leiomyosarcoma. (Figs. 6 and 7.)

Postoperatively there was no vomiting or distention. Glucose water was tolerated a few hours after surgery, and formula the following day. The skin sutures were removed on the third postoperative day and the baby went home with his mother on the fourth postoperative day.

After consultation with leading pediatricians and radiologists it was decided to withhold postoperative x-ray therapy on the basis that the risk of causing severe growth disturbances from premature closure of the epiphyses in the areas treated was greater than the risk of recurrence of the tumor.

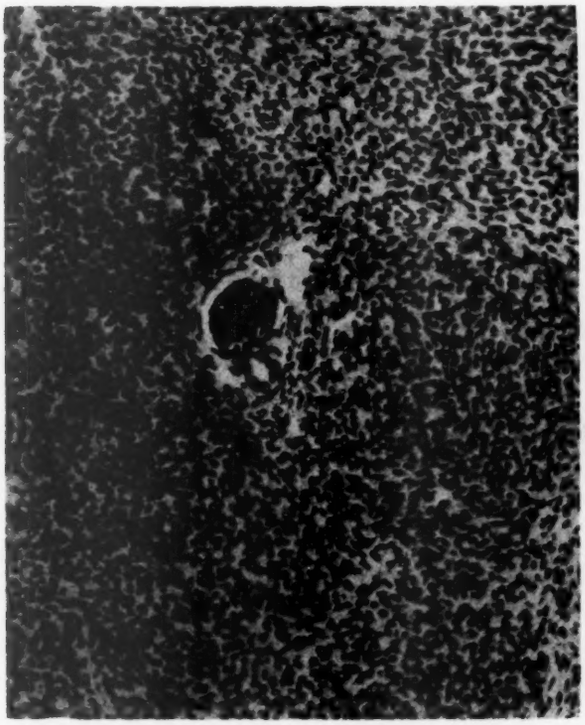

FIG. 6. Photomicrograph showing fibrous character of tumor.

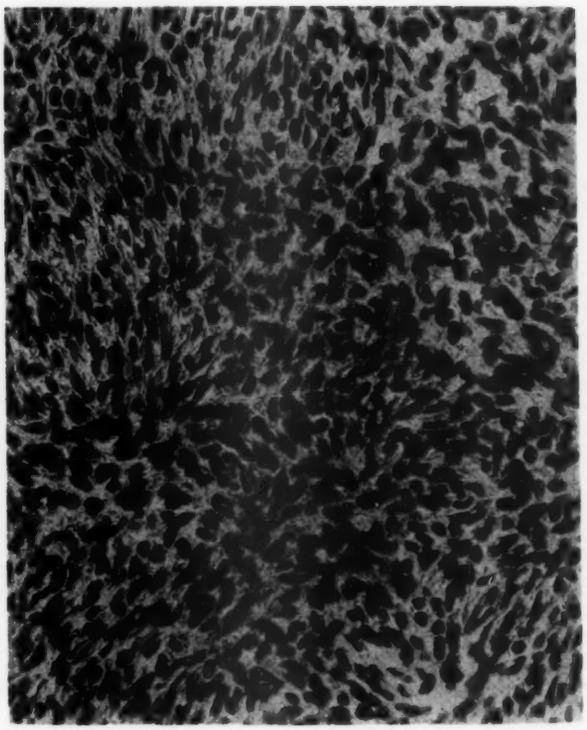

FIG. 7. High magnification showing mitotic figures.

At this writing the baby has been followed up for three years and is developing normally.

COMMENT

In the first case a favorable prognosis is probable since a unilateral polycystic kidney was present rather than one of the other entities mentioned under differential diagnosis. Lih and Waud [2], in a report of the first of three cases of tumor of the fetal kidney which have been seen at Kadlec Hospital, mention the possibility of later involvement of the remaining kidney. In all cases of unilateral polycystic kidney it is necessary to bear in mind also the possibility of concomitant cystic disease of the liver, pancreas and lung.

The second case indicates that in true neoplasm (Wilms' tumor), early surgical extirpation in the infant is no more difficult than in unilateral polycystic kidney and that the postoperative convalescence can be similarly uncomplicated. Thus prompt exploration remains the only means of avoiding instances in which complete resectability is either extremely serious or impossible.

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Kidney Stone Expelled through Skin below Healed Lumbar Incision

ZBIGNIEW ST. LEWICKI, M.D., *Warsaw, Poland*

THERE are many routes by which a kidney stone can be spontaneously passed. However, it is not the purpose of this report to discuss these routes, but rather to present an unusual case in which a kidney stone was expelled via an unusual and direct route.

In October, 1954, a forty-seven year old woman consulted us because of symptoms of advanced inflammation in the region of the left kidney. Her general condition was very poor. A roentgenogram revealed an enormous stone filling the pelvis and extending into the upper major calyx of the left kidney. (Figs. 1 and 2.) Secondary perinephritic abscess was diagnosed.

Under general anesthesia the large abscess was opened and a considerable amount of pus was liberated. The postoperative course was uneventful and the patient was discharged from the hospital four weeks later, although the incision was incompletely healed and was exuding a small amount of secretion. Secondary nephrectomy was recommended after a few weeks of rest at home.

FIG. 1. Full film before the lumbotomy.

FIG. 2. Excretory urography before the lumbotomy.

Eighteen months later she returned and stated that she had been quite comfortable in spite of the incompletely healed wound, and that just two weeks previously the wound had healed. Suddenly, without warning, she felt a painful mass below the lumbar scar. Shortly thereafter a rough body perforated the skin at this point, and she then returned for examination.

I was astonished to find the mass to be a kidney stone projecting through healthy skin. (Fig. 3.)

Roentgenograms taken at this time revealed that the original kidney stone lacked an upper fragment. (Figs. 4 and 5.) In fact, this fragment had been expelled from the kidney through a fistula and now lodged in the skin. Roentgenogram of the fistula revealed a communication between the new opening in the skin containing the fragment and the remaining stone in the pelvis.

The patient refused operation and left the hospital.

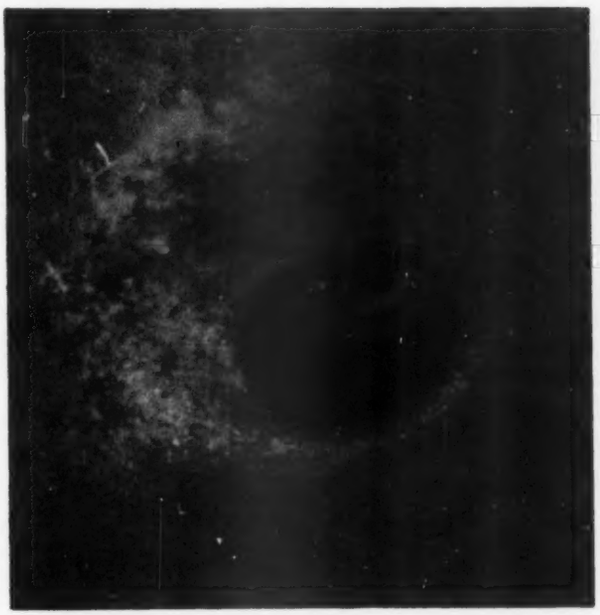

FIG. 3. Kidney stone projecting through healthy skin.

Acknowledgment: I wish to express my gratitude to Dr. Charles Pierre Mathé for his help and criticism of this paper; also to Dr. T. Dąbrowski for the photograph of the mass and Dr. E. Piętnik and the staff of the X-Ray Department of Hospital No. 4 for the x-ray photographs.

DISCUSSION

CHARLES PIERRE MATHÉ, M.D. (San Francisco, Calif.): Spontaneous expulsion of renal calculi through fistulas resulting from secondary perinephritic abscess is quite rare.

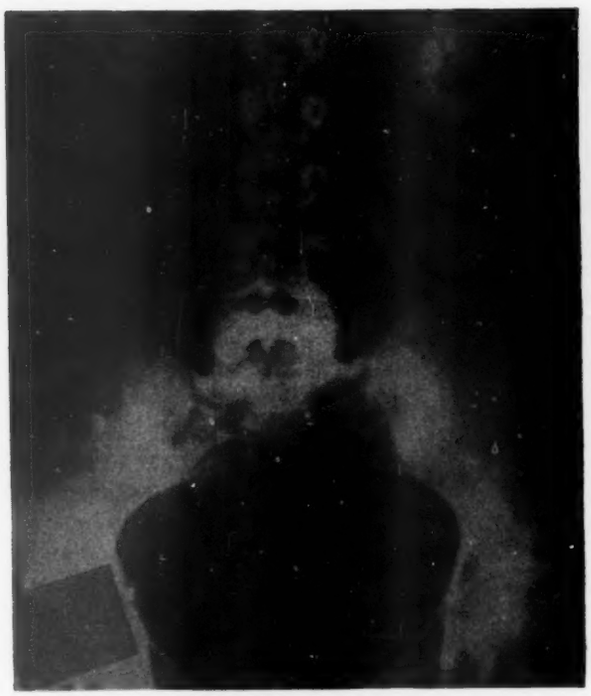

FIG. 4. Full film eighteen months later.

FIG. 5. Excretory urography eighteen months later.

I recall a case in which a stone (2.5 by 1.5 cm.) formed in a solitary congenital kidney on which a permanent nephrostomy had been performed. The ureter had been injured in the course of hysterectomy and plastic repair consisting of reimplantation of the ureter into the bladder had been unsuccessful. After repeated lavages with Suby's solution and courses of hyaluronidase therapy, it was reduced in size and spontaneously passed through the fistulous tract.

Dr. Lewicki's interesting case is an example of the way in which urinary calculi have a tendency to pass away from the kidney, be it through the ureter and bladder, a fistulous tract, a nephrostomy opening or healthy skin.

We recommend:

Human Cancer. A Manual for Students and Physicians. By Maurice M. Black, M.D., Associate Professor of Pathology and Clinical Pathology, New York Medical College, Flower and Fifth Avenue Hospitals, New York, New York; and Francis D. Speer, M.D., F.A.C.P., Professor and Director of Pathology, New York Medical College, Flower and Fifth Avenue Hospitals. 273 pages, with 34 figures, references at chapter endings and an index. Chicago, 1957. Year Book Publishers, Inc. *Price* $7.50.

Orthopedic Surgery in Infancy and Childhood. By Albert Barnett Ferguson, Jr., B.A., M.D., Silver Associate Professor of Orthopedic Surgery, University of Pittsburgh, Pittsburgh, Pennsylvania. Contributors: John Speer Donaldson, M.D., William F. Donaldson, M.D., Albert Barnett Ferguson, Jr., M.D., Robert Klein, M.D. and Frank H. Stelling, M.D. 508 pages, with 504 figures, references at chapter endings and an index. Baltimore, 1957. The Williams & Wilkins Co. *Price* $15.00. (Excellent. Above the average.)

Adenomatoid Tumor of the Epididymis

A REVIEW AND REPORT OF TWO ADDITIONAL CASES

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From the Laboratories and the Departments of Pathology and Urology, the Roger Williams General Hospital, Providence, and the Pawtucket Memorial Hospital, Pawtucket, Rhode Island.

As is well known, any tumor of the epididymis is rare, and benign tumors of the adenomatoid type are very rare indeed.

For that reason we are presenting two additional cases of adenomatoid tumor of the epididymis, with a brief review and summary of the clinical and pathologic aspects of this interesting lesion.

CASE REPORTS

CASE 1. A. D., a forty-nine year old man, entered the Roger Williams General Hospital on July 28, 1955. His family history was noncontributory and his past personal history was also irrelevant with the exception of circumcision. About one week before admission he had experienced urinary frequency, dysuria and terminal hematuria. The urine had a particularly foul odor, and he passed some soft whitish material. At the same time he complained of chills and fever. There was a long history of a slow urinary stream since birth which was not relieved by circumcision. At the time of the acute episode he noted a small painless mass in the left testicle.

Physical examination revealed no abnormalities, except for a pinpoint external meatus. A small hard mass about 2 cm. in diameter was palpated over the left epididymis. Laboratory work-up was non-contributory. Cystoscopy showed a moderate cystitis, but was otherwise non-contributory.

Meatotomy was performed. Incision into the left scrotal sac revealed a small hard mass on the upper pole of the testis immediately adjacent to the epididymis. It was removed and submitted for frozen section. After frozen section the diagnosis was still in doubt, and left orchidectomy was performed.

On pathologic examination the specimen consisted of an ovoid tumor mass measuring 3 by 3 by 2½ cm. Grossly the tumor appeared encapsulated and was light pinkish yellow in color. It cut with moderate difficulty and the cut surface was light tan-yellow in color and whorled.

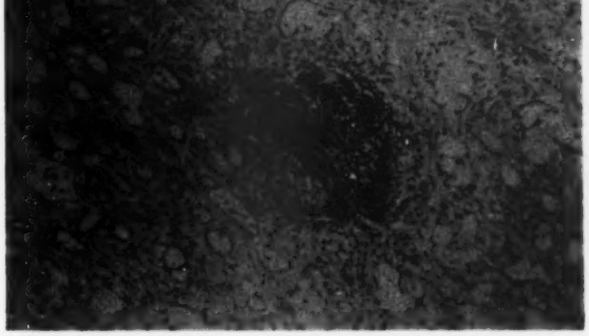

FIG. 1. Case 1. There are numerous small spaces lined by flat cells. Note focus of lymphocytes in the stroma.

Microscopically in one section a small bit of epididymis was continuous with tumor tissue. The tumor itself was composed of innumerable small, irregularly shaped, disoriented spaces, lined for the most part by flat cells somewhat suggestive of endothelium. (Fig. 1.) In other fields the glandular spaces were smaller and were lined by cuboidal cells with a somewhat acidophilic cytoplasm. (Fig. 2.) In still other areas there were cords of similar cells, generally solid, but occasionally displaying small lumens. One feature characteristic of these cells was the presence in the cytoplasm of vacuoles of varying sizes which frequently displaced the nuclei laterally, producing the so-called "signet ring" effect. (Fig. 3.)

The stroma was composed of fibrous tissue admixed with more or less smooth muscle. In a few areas the microscopic picture was monopo-

FIG. 2. Case 1. Small gland-like spaces are lined by cuboidal cells.

FIG. 3. Case 1. Note clusters of cells, many of which exhibit vacuoles in the cytoplasm.

lized by dense fibrous and smooth muscle tissue in which only rare gland-like or angeoid spaces could be detected. In the stroma there were numerous large and small ovoid zones of lymphocytic infiltration. (Fig. 1.)

The pathologic diagnosis was adenomatoid tumor of the epididymis.

CASE II. G. G. a forty-eight year old man, was admitted as an emergency case to the Pawtucket Memorial Hospital complaining of pain over the left scrotal area of two days' duration. The pain was so severe that opiates were necessary for relief. Prior to the acute episode the patient had noted, for the past two weeks, a small hard mass over the left testicular region. This mass was tender and the patient was forced to sit in a certain position so as not to touch or make pressure on the tender area. There was no history of infection or trauma, and the past history was non-contributory.

Physical examination was irrelevant except for the genitalia. The left testis was normal in size but it presented a hard mass over the lower pole. This mass measured about 1 cm. in diameter and was apparently connected to the epididymis. It was extremely tender. The epididymis also felt hard and tender, but was apparently not enlarged. Elevation of the scrotum did not relieve the pain. The right testis and epididymis were negative.

Laboratory studies were essentially negative.

At operation a hard, small tumor was found involving the lower left testis and epididymis. A presumptive diagnosis of adenomatoid tumor was made, but since the testis was involved, orchiectomy was performed.

The pathologic specimen consisted of a testis and about 5.5 cm. of attached spermatic cord. On the testis, at its lower pole, there was a previously opened, non-encapsulated, round mass measuring 1 cm. in its greatest diameter. It had a greyish tan, bulging cut surface. In some areas the tumor was greyish white and centrally showed a zone of gray-tan tissue with a rim of hemorrhage. The testis and spermatic cord revealed no abnormalities.

Microscopically there were gland-like spaces of varying sizes and shapes, lined by epithelial like cells and set in a fibrous stroma. (Fig. 4.) The lining cells had a pink granular cytoplasm and round to oval nuclei. Smooth muscle bundles and lymphoid aggregates, chiefly perivascular in location, were seen within the stroma. In some areas polymorphonuclear infiltration was seen. (Fig. 5.) The tumor was non-encapsulated and some of its fibrous stroma merged with that of the adjacent testis. In the testis there was atrophy and fibrous replacement of the seminiferous tubules, with hyperplasia of the Leydig cells.

The pathologic diagnosis was adenomatoid tumor of the epididymis.

COMMENTS

This rare and controversial tumor was first described by Sakaguchi [1] in 1916, and since that time the variety of its names reflects the divergent theories as to its histogenesis. The lesion has been designated as an adenoma, adenocarcinoma, epididynoma, mixed tumor of the epididymis, angiomatoid tumor, adenofibromyoma, lymphangioma, mesothelioma and adenomatoid tumor.

Longo, McDonald and Thompson [2] in 1951 published an excellent article, reviewing this subject thoroughly and adding seventeen cases of adenomatoid tumor to the seventy-one cases which they were able to find in the litera-

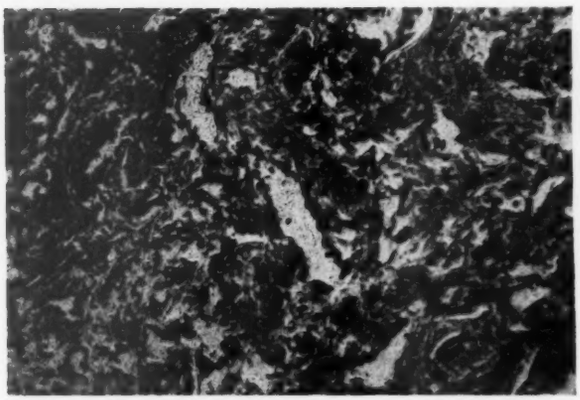

FIG. 4. Case II. Gland-like spaces lined by epithelial cells are set in a fibrous stroma.

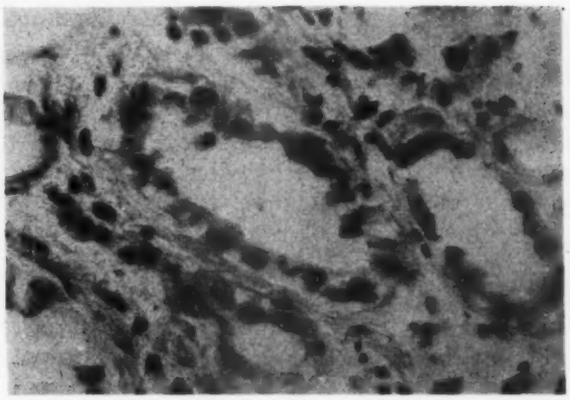

FIG. 5. Case II. The stroma, containing numerous gland-like spaces, is sprinkled with polymorphonuclear leukocytes.

ture up to that time. This article brought the total to eighty-eight reported cases.

In the review by Longo, McDonald and Thompson [2], the average age of their patients was 41.5 years (twenty-one to seventy-eight). The chief complaint in the majority of cases was the presence of a tumor, although sometimes the tumor was an incidental finding at operation. Pain was a rare complaint. The duration of symptoms varied from three days to thirty years. Occasionally a small hydrocele was associated with the tumor.

Most of the patients were Caucasians, but the lesion has been described in Negroes and Orientals. There has never been a record of metastasis or recurrence.

Grossly the tumor is usually described as small, measuring about 2.5 cm. in its largest diameter. It is globular, encapsulated, firm and well circumscribed. The cut surface is described as yellow or greyish white, often exhibiting a whorled pattern much like that of a leiomyoma.

Microscopically the tumor presents a thin fibromuscular capsule. The stroma is composed of fibrous tissue, either loosely arranged or dense and rich in collagen. Smooth muscle fibers are always present, occasionally monopolizing the field. Vascular spaces are uncommon.

In the stroma there are characteristic empty or gland-like spaces, arranged in loose formation or in cords, lined by flat cuboidal to low columnar cells, and in the latter a fine granular eosinophilic cytoplasm is seen. There is a prominent round, oval, vesicular nucleus, with a single nucleolus. There are no mitoses. Many of these cells display vacuoles of varying size and present a "signet ring" shape from lateral nuclear displacement. Frequently these intracytoplasmic vacuoles fuse to form larger conglomerate spaces. Scattered nests of lymphocytes are usually present in the stroma.

This type of tumor is encountered not only in the epididymis but also on the ovary, fallopian tubes, posterior subserous uterus, testicular tunics and spermatic cord.

The histogenesis of this tumor is still a debatable question and several theories have been proposed.

Evans [3] champions the theory of a mesothelial origin, and calls these tumors mesotheliomas. He directs attention to the occurrence of identical tumors on the uterine serosa, tubes, ovaries and testicular tunics. Evans describes one uterine subserous tumor in which he was able to trace a continuity of the gland-like spaces with the overlying mesothelial cells. Others have advocated the theory of an endothelial origin. Still others have considered the gland-like spaces to be of epithelial origin and have referred to the tumor as an adenoma, or even, in the case of Thompson [4], as an adenocarcinoma.

However, Golden and Ash [5], in view of these divergent and apparently irreconcilable theories, have proposed the non-committal name of adenomatoid tumor which is the preferred designation today. It is indeed the opinion of the present authors that the name "adenomatoid" tumor should be retained to avoid the confusion of numerous synonyms, until such time as the histogenesis of this lesion has been irrefutably established.

However, Longo, McDonald and Thompson [2] have suggested another interesting possibil-

ity. They stress the fact that although there may be strong indications in favor of a mesothelial origin, nevertheless the areas of occurrence of this tumor are restricted to the male and female genitalia, although the distribution of mesothelium is much wider. They further point out that the tumor occurs along the embryologic course of the mesonephros. With these factors in mind, these authors suggest that these lesions might be regarded as hamartomas of the mesonephros. In 1904 Albrecht [6] introduced the concept of a hamartoma, defining this lesion as a "tumor like malformation in which occurs only an abnormal mixing of the normal components of an organ." As is well known, hamartomas have been described in the bronchi, liver, spleen and other organs.

Since the publication of the article by Longo et al. [2], several others have appeared.

Falk and Kronwaler [7] described a tumor of the epididymis in a Negro, the histology of which was that of an adenomatoid tumor. These authors considered the lesion, however, to be of chronic inflammatory origin, and believed that it was not neoplastic.

Meeter and Schwartz [8] added two cases to those already recorded, and Rappoport and Morgan [9] reported two more.

Some of the diagnostic problems, particularly with frozen sections, are emphasized in an interesting article by Lazarus and Friedman [10]. They reported a tumor removed from the right epididymis of a seventy-year old patient. On frozen section a diagnosis of adenocarcinoma was made. From the permanent sections the lesion was diagnosed as a lymphangiosarcoma of low grade malignancy. Lazarus and Friedman believed that the tumor actually was an adenomatoid tumor, which, from their photomicrographs would appear to be the most likely diagnosis.

Ambrose [11] recorded an adenomatoid tumor presenting on the parietal surface of the tunica vaginalis. He believed that there was a demonstrable continuity between the serosa cells and the tumor elements indicative, therefore, of a mesothelial origin.

Sundarasivarao [12] added six more cases to the literature and believed that the lesions arose from müllerian vestiges.

Finally, Cameron [13], Duffy [14], and Negri and Smorlesi [15] each reported a single case, and Mylius [16] added five more cases of adenomatoid tumor to the literature.

These reports, plus the two cases reported herein, bring the total number of reported cases of adenomatoid tumor, insofar as we have been able to ascertain, to 110 recorded cases.

SUMMARY

1. Two additional cases of adenomatoid tumor of the epididymis are added to the literature, bringing the total to 110.

2. One of our cases was characterized by excruciating pain, which is a rare accompaniment of this lesion.

3. Various theories of histogenesis are reviewed.

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Recurrent Laryngeal Nerve Paralysis Occurring in an Infant

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THE finding of unilateral recurrent laryngeal nerve paralysis in an eleven month old infant aroused considerable interest recently at the Queen of Angels Hospital. Because of the rarity of this condition in infants, we believe the case is worth reporting. We have been unable to discover a like case in the literature, with the exception of one reported by Jackson and Jackson [1]. Their case was a chondroma occurring at or near the nucleus ambiguus in the pons cerebri.

CASE REPORT

The patient was an eleven month old infant, admitted to the Queen of Angels Hospital (Case No. 12343) with a history of frequent colds, nausea, vomiting and some weight loss over a three-month period. During the last two weeks prior to admission the child had cried with a hoarse voice. Neurologic examination revealed no abnormalities. The reflexes were normal and the eye grounds did not show any papilledema. X-ray studies of the chest, esophagus and trachea were not helpful. Laryngoscopy revealed abduction paralysis of the right vocal cord with some edema of the glottis. The left cord moved in a normal manner.

Several consultants examined the child and considered the possibility of pressure on the recurrent laryngeal nerve in the chest caused by some form of tumor or possibly by a granulomatous lesion. However, no pathologic condition was found in the chest or neck which would account for the paralysis. We therefore suggested that a tumor in the area of the pons cerebri could be the cause of this paralysis. Owing to the paucity of positive neurologic findings and the reluctance of the parents to agree to further study of the patient, no additional diagnostic or therapeutic procedures were performed and the child was allowed to go home.

Two months later the patient's condition suddenly became worse and she was admitted to the Children's Hospital with a history of difficulty in swallowing, vomiting of more than half her food and, as on the previous admission, suffering from almost continuous upper respiratory infections. The most important finding at this time was severe bilateral papilledema. In the working diagnoses, a tumor of the pons was considered. Before further studies could be made, the child's condition deteriorated rapidly and she died in a few hours.

At autopsy a tumor (spongioblastoma multiforme) was found in the right cerebellar hemisphere and seemed confluent with the right side of the pons and medulla. The medulla was displaced to the left. There was direct pressure on the cranial nerves from the fifth to the twelfth. Also, a portion of the tumor herniated into the foramen magnum. The ventricles of the brain were distended and a marked hydrocephalus was present. Incidental findings were pulmonary edema, otitis media and bronchitis.

COMMENTS

One of us [2] published an article dealing with the subject of recurrent laryngeal nerve paralysis. Figures 1 and 2 and Table 1 are reproduced from this publication. These figures illustrate the long course taken by the vagus nerve. Pressure on the nerve at any point might cause paralysis. The recurrent laryngeal nerve is a branch of the vagus nerve and supplies all the muscles of the larynx except the cricothyreoideus which is supplied by the superior laryngeal nerves. These were probably also involved in the case reported, since the superior laryngeal nerves are also branches of the vagi arising high in the neck. In considering the clinical diagnosis, we took into consideration all the possibilities outlined in Table 1. We were sure there was nothing pressing on or involving the nerve in the neck. The various consultants considered some intrathoracic involvement. It can be seen, however, in Figures

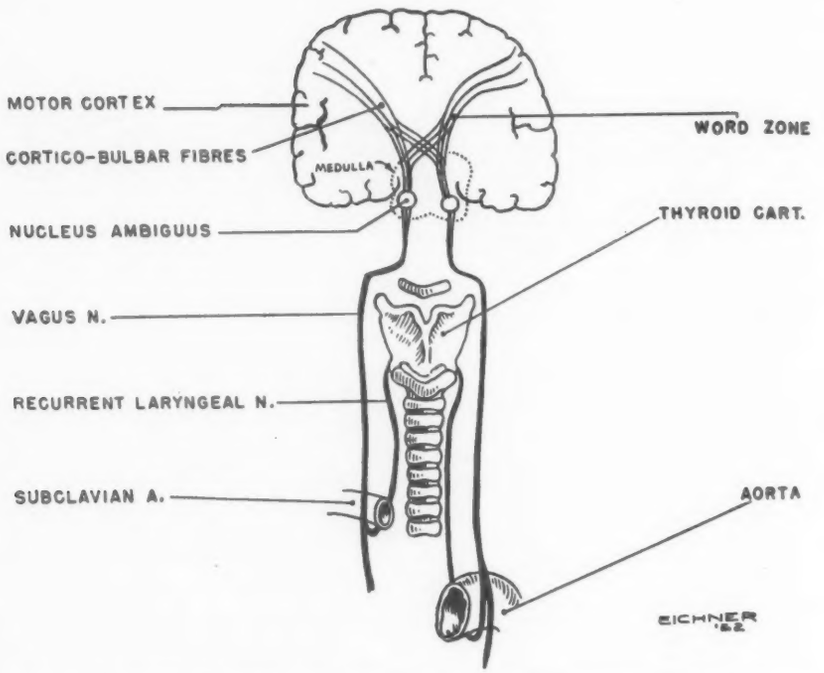

FIG. 1. Concept of origin and course of recurrent laryngeal nerve. (From: Ross, D. E. *Am. J. Surg.*, 85: 729–737, 1953 [2].)

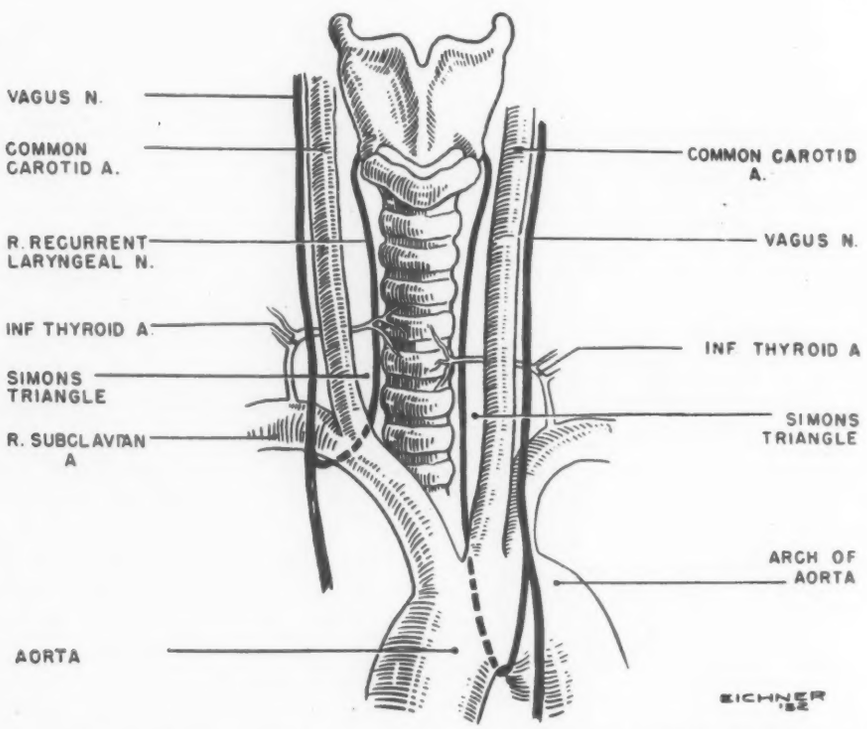

FIG. 2. Shows the course of the two vagi nerves. (From: Ross, D. E. *Am. J. Surg.*, 85: 729–737, 1953 [2].)

TABLE I

CAUSES OF PARALYSIS OF THE VOCAL CORDS

Traumatic:	To the nerve in any part of its course
Neurosis:	Hysteria Laryngeal spasms of neurologic origin Adductor spasm Incoordination Intermittent or abductor paralysis
Miscellaneous:	Tabes Disseminated sclerosis Bulbar disease Syringomyelia Poliomyelitis Neuritis of the nerve itself Myasthenia gravis Diabetes
Pressure on nerve:	Tumors (malignant or benign)—Thymoma Neurofibroma Carotid body tumor Branchial cyst Cancer of esophagus Tuberculosis (lymph nodes in neck or chest)—Pleuritis Syphilis Hematoma Goiter (cervical or thoracic) Aneurysm (in neck or thorax) Adenopathies—Lymphatic leukemia Hodgkin's disease Thickened pleura Pericardial effusion Pericarditis Dilatation of left auricle Tumor in 4th ventricle (medulla)
Toxic poisons:	Vegetable (alcohol or tobacco) Metallic (lead, mercury, bismuth, copper, silver) Systemic infection—Diphtheria Pneumonia Influenza Typhus Erysipelas Ptomaine poisoning Serum disease Botulism
Adhesion in the neck:	Thyroiditis Postoperative
Operative:	A. Stretching the nerve or pressure Ligating the nerve Cutting the nerve B. Presence of anomalies of the anatomy, particularly of the nerve itself (see illustrations)

(From: Ross, D. E. *Am. J. Surg.*, 85: 729–737, 1953 [2].)

1 and 2 that the right recurrent nerve arises from the vagus nerve on the anterior surface of the subclavian artery. The recurrent nerve then winds around the subclavian artery and passes up posteriorly to this vessel, running upward and slightly inward toward the trachea. Since it scarcely enters the chest at all, it would therefore seem unlikely that pathologic disease in the chest would be a causative factor. The obvious conclusion was that the patient suffered from some intracranial lesion in the region of the pons just below the nucleus ambiguus. Unfortunately, this suggested diagnosis was not followed up, since the child's parents insisted on taking her home. It was interesting to learn of the subsequent course, which terminated with autopsy findings which substantiated our tentative diagnosis.

SUMMARY

1. Recurrent laryngeal nerve paralysis occurring in an infant is extremely rare. Such a case is reported herein.

2. The subject of recurrent laryngeal nerve paralysis is reviewed.

3. The diagnosis of a lesion of the pons pressing on the vagus nerve and causing recurrent laryngeal nerve paralysis was suggested as a clinical diagnosis. It was interesting to find that the autopsy findings corroborated this diagnosis.

Acknowledgment: We wish to thank Dr. David J. Rottapel, who was in charge of this case at the Queen of Angels Hospital, for permitting this report, and also the staff and Record Room of Children's Hospital, Los Angeles, for use of their reports on the admission, clinical course and autopsy findings in this case.

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Decompression of the Spinal Cord in Pott's Paraplegia

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THE introduction of the antituberculosis drugs has allowed a review of many of the accepted methods of treatment of tuberculosis and has permitted the development of surgical technics which previously would have been regarded as hazardous in the extreme.

Rest to the diseased part and the prevention of secondary infection have formed the basic principles of treatment. It is possible, however, that too rigid an application of these principles may, in certain circumstances, be as harmful as would too liberal an application.

It is known that in the majority of cases in which paraplegia complicates Pott's disease the paralysis will disappear as the disease process subsides and as the inflammatory exudate and abscess are absorbed. Furthermore, it has been widely accepted that a surgical attack on the compressive lesion would lead to draining sinuses, with secondary infection, increased instability of the spine and spread of the disease with serious if not fatal consequences. For this reason the treatment of the actual site of the disease within the spine has been conservative. However, in a number of cases the disease appears to become quiescent on this regimen; the sedimentation rate and temperature return to normal, yet the paraplegia does not regress. It is in these latter cases which are not controlled by routine methods that some alternative therapy appears indicated.

Seddon [*1,2*] points out that the essential pathologic lesion consists of a collapse of the bodies of the affected vertebrae, with posterior herniation of the abscess material and intervertebral disc, and angulation of the spine. The cord is therefore compressed into the lamina behind by the posteriorly protruding mass and is also stretched over the kyphosis in front. In old cases the kyphosis may be ossified into a bony ridge which sticks backward into the ventral surface of the spinal cord. Evidence of spread of the disease into the tissues enclosed by the dura mater is wanting. Chavagny and Daum [*3*] and Nisbet [*4*] noted that the dura mater was not involved in the inflammatory process, and that the granulation tissue could be stripped off with ease. Paraplegia occurs as a result of direct compression of the cord or its vasculature by the extradural mass.

It is clear, therefore, that there is an indication for some surgical intervention designed to decompress the cord in those cases in which recovery of function does not occur after immobilization of the spine by fusion. Bosworth, Pietra and Rahilly [*5*] found in a series of 122 patients that recovery of function occurred only in those in whom there was solid spine fusion. In a small series of cases Johnson, Hillman and Southwick [*6*] showed that the incidence of dissemination of the disease was markedly less when streptomycin was used on the region of the infection prior to and after surgery than when it was not used, and some physicians now believe that modern antibiotics have so reduced the dangers associated with surgery of the diseased area that the danger of permanent paraplegia is the greater evil at this time.

Such an operative procedure must allow adequate decompression of the cord without impairing the stability of the spine. In some cases simple laminectomy without removal of the articular facets may be adequate, while in others access must be gained to the anterior surface of the dural sac to allow removal of

material from that region. This point has been made by several authors (Seddon [2], Nisbet [4], Girdlestone [7], Alexander [8] and Dott [9]), who have attempted to reach the posterior surface of the vertebral body by costotransversectomy or anterolateral rachiotomy, in which the head of the rib and the pedicle of the vertebra on one side are removed without removing the articular facet. This type of operation is particularly suitable for late cases in which spinal fusion has already been performed. Love [10] has succeeded in approaching the posterior surface of the vertebral body through extensive laminectomy.

The following case is reported because it appears to illustrate a number of the aforementioned problems.

CASE REPORT

E. T., a seven year old girl, was first admitted to Bellevue Hospital on July 16, 1952. She gave a history of having suffered pain in the upper back for three years following a febrile attack, with the development of kyphosis. She had been treated in another hospital with bedrest and the application of a plaster of paris jacket. She made little improvement and the pain returned when the cast was removed four weeks prior to her first admission to Bellevue Hospital.

Physical examination at that time showed a well developed girl with marked kyphosis in the upper thoracic region. X-ray of the dorsal spine showed collapse of the second, third and fourth thoracic vertebrae. Chest roentgenogram showed calcified hilar nodes, with a calcified focus in the right upper lung field, but no evidence of active tuberculosis. The patient's temperature ranged between 97.8° and 99.8°F. The Mantoux test was positive 1/100. The sedimentation rate was 7 mm. in one hour.

A diagnosis of Pott's disease of the spine was made.

She was treated first with bedrest and antibiosis. She had a brief episode of fever. In April, 1953, spinal fusion was performed from C7 to T8. She was placed in a Minerva jacket and made steady improvement. She was discharged as asymptomatic in October, 1953.

The patient was readmitted to Bellevue Hospital on January 8, 1954, having had such progressive weakness of the lower limbs during the previous month that she could barely walk, even with support. There was no sensory loss, or loss of bladder or bowel control. The lower limb reflexes were hyperactive. Weakness progressed over the next month despite bedrest, until she was completely paralyzed. Bladder control and sensation were, however, unaffected.

On April 26th the old fusion was re-explored and found to be intact. It was, however, extended upward by one vertebra. There was no improvement in the patient's condition following this procedure. The disease process, however, appeared inactive, since the sedimentation rate was 13 mm./hour on July 19th and 8 mm./hour on October 7th.

The patient was re-evaluated on November 18th. Neurologic examination showed a complete loss of motor function from the upper thorax downward, with spasticity, but bladder and bowel control and sensation were normal. There was no sensory abnormality apart from a suggestion of impairment of vibration sense in the ankles. Queckenstedt's test, with the neck cuff inflated to 80 mm. Hg, showed a complete subarachnoid block to be present. X-ray films of the dorsal spine showed severe kyphosis, with collapse of the second, third and fourth thoracic vertebrae with a solid posterior fusion. Pantopaque® myelography by lumbar and cisternal routes showed a complete obstruction extending from T1 to T4.

It was believed that the cord was being compressed by posteriorly displaced abscess, disc or bony material. In view of the fact that the spine was quite secure—the state of the fusion having been ascertained at surgery—it was considered desirable to decompress the spinal cord by the anterolateral route.

Operation was performed on November 19th. Under general endotracheal anesthesia the patient was placed on her left side, in the three-quarter prone position, and an incision was made over the spines of T1 to T6. The rhomboid and trapezius muscles of the right side were separated from the spine and pulled laterally, and the erector spinae muscles pulled medially. The periosteum over the third, fourth and fifth ribs was incised and elevated from the bone for a distance of approximately 3 inches from the transverse process. The bone was removed and that part which remained anterior to the transverse process itself was rongeured away. The fourth intercostal nerve was dissected and followed to its foramen, which thus provided an excellent landmark. The vertebral canal was therefore approached

from its lateral aspect by removing the pedicles and transverse processes and the medial ends of the three ribs. An extremely hard, bony protuberance was found pressing backward onto the cord in the region of T3 to T4. This was removed with an osteotome. In this way the pressure on the anterior surface of the cord, which was caused by the sharp edge of the gibbus deformity, was relieved, and the dura mater, which had been pulseless, appeared to beat throughout its length. It was thought that the obstruction had been relieved.

Postoperatively the patient's condition was excellent although her temperature was elevated at first. The wound healed well and the sutures were removed on the tenth postoperative day.

On December 9th Queckenstedt's test was performed. With the sphygmomanometer cuff around the neck and the mercury pressure elevated to 60 mm. Hg there was a slow rise in pressure of the cerebrospinal fluid from an initial pressure of 90 mm. to 265 mm., with an even slower fall back to the original pressure over the next four minutes. This was taken to indicate that a severe degree of block was still present. The test was repeated on December 29th, with essentially similar findings. The sedimentation rate was 46 mm./hour. There was no change in her neurologic status.

On January 11, 1955, fifty-three days after operation, a slight fluctuation was noted over the area of the wound and two days later it broke down and began to discharge greenish pus. This discharge was negative on smear, and later on culture, for tuberculous organisms, but Staphylococcus albus was grown from it. Unfortunately a guinea pig test was not performed. The patient's temperature became elevated and swinging. It was believed that this represented a cold abscess which had ruptured onto the surface and had become secondarily infected, rather than an abscess in an infected operative site. Streptomycin, isonicotinic acid, penicillin and terramycin® were administered in large doses and the temperature soon returned to normal.

On January 15th a myelogram was taken, using the residual pantopaque from her previous myelogram, and it was seen that the obstruction in the region of her gibbus had re-formed or had never been completely relieved. Drainage from the wound continued.

On January 17th the patient moved her left toe, and on the following day voluntary motion was noted in all the toes of that foot. Queckenstedt's test showed that a partial block was present. With a sphygmomanometer cuff inflated to 60 mm. Hg around the neck, the cerebrospinal fluid pressure rose from an initial 240 mm. to 380 mm. in thirty seconds. After removal of the pressure the cerebrospinal fluid pressure fell again to its original value in the same period of time.

This result represented a considerable advance over the previous rests. On January 22nd a further collection of pus appeared over the region of T6. This was aspirated in an effort to prevent rupture to the surface. It likewise was negative for tuberculous organisms and grew Staph. albus.

After approximately one week the abscesses ceased to discharge and granulation began. Recovery of motor function then proceeded apace. On January 25th the patient was moving her entire left foot, and by February 1st she had regained some power in all the muscles of her left leg.

Recovery in the right leg lagged somewhat, but appeared during the first week of February. By February 17th she had very good power in the left leg with full movement, but there was some reduction in power in the right leg. During the next month good power and full movement were regained in both limbs.

Queckenstedt's test performed on April 9th showed no evidence of any obstruction. The sedimentation rate was 7 mm./hour. The patient's temperature was consistently normal. On August 1st she was able to walk with crutches and attended a children's camp for three weeks.

COMMENTS

There seems every reason to believe that the return of function and relief of the obstruction shown by Queckenstedt's test was directly related to the rupturing of the abscess and the discharge of pus, since function began to return within six days of the start of drainage of the abscess and fifty-nine days after surgery. It must be presumed that the surgical procedure was responsible for removing the anterior ridge but did not succeed in completely relieving the obstruction since the abscess remained undiscovered. It did, however, provide a path for the pus to track to the surface. As the pus was evacuated, apparently from the region

around the spinal cord, the remaining pressure was relieved and the cord was enabled to function normally again.

This case therefore gives impetus to the thought that there is a very real advantage to be gained by a properly conceived surgical decompression in Pott's paraplegia, by the removal of protruding bone and degenerated elements and also by the aspiration of pus when present. Girdlestone had a similar case in which the patient recovered from paraplegia following the coincidental drainage of a paraspinal abscess, while Nisbet observes that patients with tuberculosis of the spine in whom a sinus develops rarely become paraplegic. He reported on eight patients, all treated at various stages of their disease by decompression and removal of abscessed material. Six of the patients made good recoveries; two did not recover and ultimately died, one with a pathologic fracture.

There are, however, several points that must be borne in mind. It has been universally accepted that decompression during the early phases of this disease can be disastrous. The spine at that time is unstable, there being active destruction of bone, and injudicious surgery may merely enhance this instability so that the disease, far from being cured, is only aggravated. This is particularly so if any of the stabilizing elements such as articular facets are removed. It would seem wise to wait for the appearance of some degree of stability to return to the spine by quiescence of the disease following immobilization of the patient in a cast, or by fusion, before considering the question of a surgical exploration to relieve the paraplegia.

On the other hand, it may well be that there is a tendency to be more conservative than conditions justify. Girdlestone believes that if there is no evidence of recession of the paraplegia within six weeks, a decompressive procedure should be undertaken in most cases; depending on the type of involvement and deformity, this would consist of costotransversectomy or laminectomy. Lateral rachiotomy he would reserve for early or late paraplegia in which a posterior spine graft was already in place.

The majority of orthopedists and neurosurgeons would not subscribe to such an opinion, believing that a longer period should be allowed to elapse before such treatment is considered. It is possible, however, that we are being overconservative and that earlier decompression should be undertaken. In Nisbet's series the shortest duration of paraplegia was two months; this patient was still doing well three years after the removal of an encapsulated abscess pressing on the theca. The two patients who did poorly were those in whom the paraplegia had been present for two or more years.

Certainly there is every reason to suppose that it would have saved much time, as well as decreased the risk of permanent paraplegia, had our patient been decompressed at the time of her readmission, or at least after the stability of her old fusion had been demonstrated at surgery four months later. It is interesting to observe how long paraplegia can be present in Pott's disease (almost a year) with a complete return of function. The fact that the paralysis regressed when the abscess ruptured suggests that the abscess was at least as important in the production of the paraplegia as was the bony ridge. The fact that there was no increase in angulation of the spine also suggests that the abscess was more important than was the kyphosis.

In our patient the paraplegia developed after her discharge from the hospital, but at the time of her readmission no signs of active disease were found. It seems likely therefore that the weight bearing, even though the spine was well fused, was sufficient to squeeze pus and necrotic material from within the vertebral body into the canal. When paraplegia occurs in the presence of apparently well healed disease, it should probably be regarded as an indication for re-exploration and decompression. The rapid subsidence of the paraplegia following discharge of the abscess supports the contention that mechanical compression of the spinal cord, rather then permanent obliteration of the vasculature, is the primary lesion in these cases.

SUMMARY

A case of Pott's disease of the thoracic spine in a young girl has been reported.

This patient became paraplegic after she was discharged from the hospital, asymptomatic, with solid spinal fusion. Re-exploration showed that the spinal fusion was intact, and lateral rachiotomy disclosed a bony ridge pressing backward upon the spinal cord. Removal of this ridge did not result in regression of the paraplegia until after an abscess had

appeared on the surface, having apparently tracked up the path of the surgical procedure. The paraplegia then began to regress and the patient went on to make a complete recovery.

This suggests that when the paraplegia does not subside rapidly after signs of healing or of good fusion, or when late paraplegia appears in the presence of a good fusion, exploration should be done and such abscess material as can be found should be removed. Antibiotics render such a procedure much safer than formerly.

Our patient did not become paraplegic until she was ambulatory. It seems likely that despite the solid fusion weight bearing had forced some purulent material, which was formerly lying within the vertebral body, out into the canal space, with development of pressure on the cord and paraplegia.

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Dislocation of the Clavicle below the Acromion

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THE following case of downward dislocation of the outer extremity of the clavicle seems worthy of description in view of the rarity of the injury. So uncommon, indeed, is this lesion that an extensive review of the literature has disclosed only fifteen authenticated cases on record. All except one of these cases were reported before the introduction of roentgenography, and there is no mention of a roentgenographic examination in the fifteenth case which was published in 1897. It would seem, then, that the following case of subacromial dislocation is the first to be reported in which the diagnosis was confirmed by an x-ray.

REVIEW OF LITERATURE

The possibility of subacromial dislocation was admitted by Petit [*14*] as early as 1726. Later, he must have encountered the injury, for it is stated in his book entitled "Oeuvres Complètes," published in 1837, that he had observed cases of clavicular dislocation downward.

A case was described for the first time by Melle [*11*] who, in 1773, reported the details of a dissection of a shoulder with this injury. From 1773 to the time of writing, a period of 183 years, only fourteen more cases have appeared in the literature. One case each was reported by Fleury [*7*], Tournel [*15*], Baraduc [*2*], Butcher [*3*], Uhde [*16*], Koch [*9*], Chase [*4*], Allen [*1*], Eaton [*5*], Koenig [*10*] and Edwards [*6*]; one case was reported from King's College Hospital, London [*8*]; and two cases were described by Morel-Lavellée [*12*]. The latest case in this group was contributed by Edwards in 1897, nearly sixty years ago.

CASE REPORT

A. P., a twenty-seven year old man, felt something snap in the right shoulder when he was lifting a log with a heavy peavey on July 5, 1954. He experienced excruciating pain at the moment when the shoulder gave way, and the arm dropped limp to the side.

The patient was seen on the day following the accident. The shoulder was extremely painful, with pain radiating down the arm. The head and trunk were inclined toward the injured side. There was a deep depression internal to the acromioclavicular joint.

The diagnosis of a downward dislocation of the outer clavicular extremity, suggested by the clinical observations, was established by roentgenographic examination. Anteroposterior roentgenograms of both shoulders were obtained for purposes of comparison. (Figs. 1A and B.) On the right side, the outer end of the clavicle was displaced downward and slightly backward. The unusual conformation of the acromioclavicular joints on both sides, which will be discussed further on in the paper, was likewise noted.

An attempt was made to reduce the dislocation by manipulative maneuvers, with the patient under intravenous anesthesia. Strong traction was exercised on the shoulder in a backward and outward direction, the arm being held in the position of abduction and flexed at the elbow. The clavicle failed to disengage itself. A general anesthetic was then administered to establish complete muscular relaxation. As the second attempt at manipulation was begun, reduction took place practically spontaneously. (Fig. 2.) Upon testing the articulation for stability following this "spontaneous" reduction, some crepitation was elicited, but the joint appeared to be as stable as on the unaffected side.

A sling holding the forearm flexed at the right angle was used for a retentive dressing.

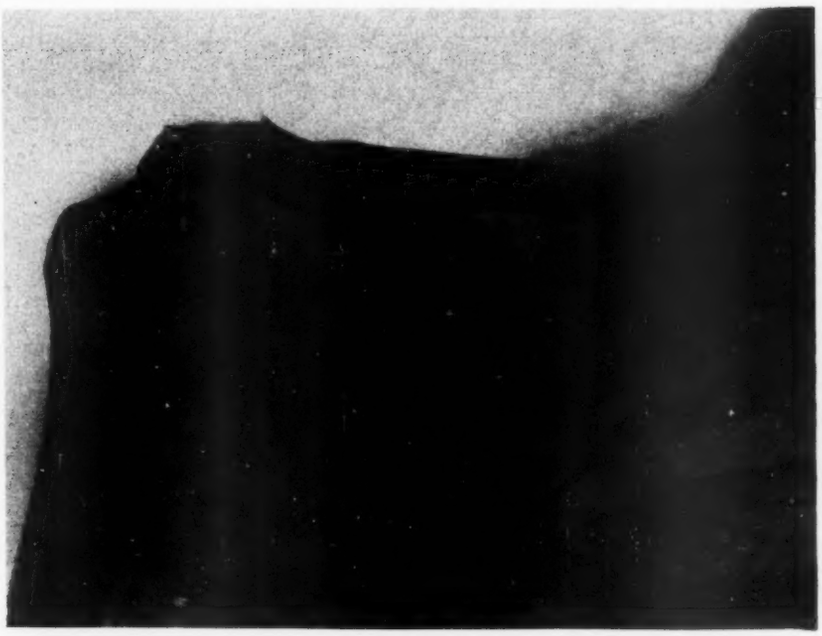

FIG. 1A. Roentgenogram showing downward dislocation of the outer clavicular extremity on the right side. Note the unusual conformation of the acromioclavicular joint.

FIG. 1B. Roentgenogram of the left shoulder which shows less pronounced anatomic variation of the acromioclavicular joint.

FIG. 2. Roentgenogram taken following "spontaneous" reduction with the patient under general anesthesia.

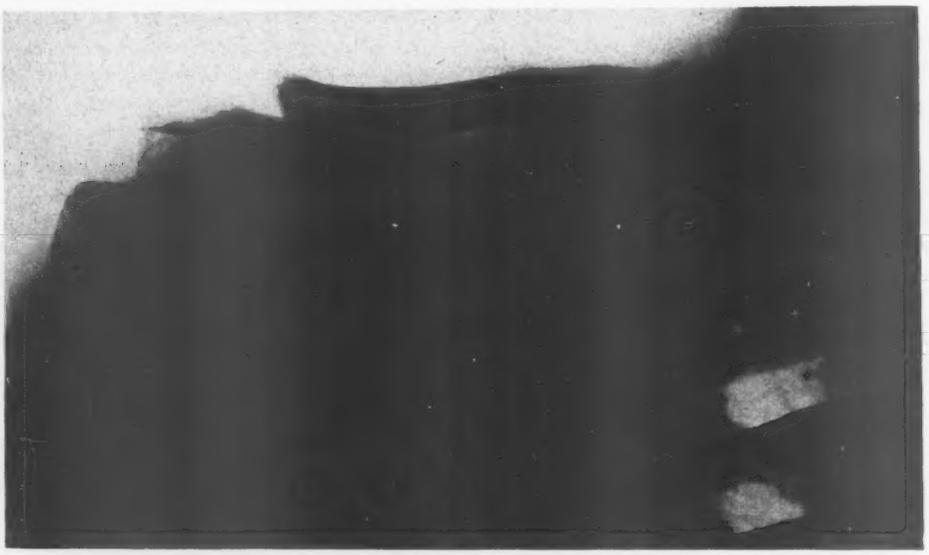

FIG. 3. Roentgenogram taken two years after the injury, showing elevation of the clavicle and bony irregularities at the joint level indicative of capsular or periosteal damage.

Immobilization was continued only until the soreness had subsided. The patient was then encouraged to exercise the arm and use it normally.

A re-examination of the patient's shoulder was recently made, two years after the injury. Figure 3 shows a roentgenogram taken at the time of the follow-up. There is slight subluxation of the acromion under the clavicle, and several small islands of bone lie at the joint level which, undoubtedly, represent periosteal or capsular damage at the time of the original injury. Clinically, the joint is more prominent than that on the left side. No pain has been experienced and there has been no suggestion of a recurrence of the dislocation. Mobility at the shoulder is quite complete. The arm seems to be as strong as before the injury. The patient stated that he had recovered the use of the arm rapidly. He had returned to lumbering approximately one month after the injury and he had continued at that heavy work for six months.

At the present time he is working in a ball-bearing factory where his duties are light.

COMMENTS

A downward dislocation of the outer clavicular extremity of the type described in this case can occur only if there is an unusual anatomic arrangement of the joint. The acromioclavicular articulation on the right side was of the type in which the joint surfaces are oblique, with the clavicular end over-riding the acromion. This is a mechanically weak joint, predisposing to displacement of the clavicle upward or downward in case of trauma [*13,17*]. Moreover, the articular surfaces were unusually oblique, lying at an angle of 45 degrees; this factor explained the dislocation in a downward direction. On the left side, anatomic variations of the joint were less pronounced.

The production of the lesion may be traced to muscular effort. The handling of heavy logs incidental to the patient's occupation could cause stretching of the ligaments which, in combination with the peculiar conformation of the articular surfaces, explained the downward dislocation of the clavicle. Muscular strain had been considered an etiologic factor in two of the fifteen cases described in the literature, both of which were reported in 1881 [*1,5*]. One of the patients was a carpenter who had strained himself lifting, and the other was a young girl whose shoulder had given way while she was splitting wood. In twelve of the other cases on record, the injury had been the result of a fall or a direct force exercised on the upper surface of the outer end of the clavicle.

The result in the case reported herein, as stated previously, is excellent at the end of two years. It will be interesting to continue to follow up the patient to see if arthritic changes develop. It is also entirely possible that the dislocation may recur, now that the clavicular extremity has once been displaced.

SUMMARY

There are only fifteen authenticated cases of dislocation of the clavicle below the acromion on record. In no instance had the diagnosis been confirmed by a roentgenogram.

A case of this rare lesion is described in which a roentgenographic examination made clear that the unusual configuration of the acromioclavicular joint was a factor predisposing to downward dislocation of the outer clavicular extremity. Reduction was easily obtained with the patient under general anesthesia. Recovery of the use of the arm was rapid, and the patient, when examined two years after the injury, had no complaint. For a period of six months he had continued at his regular work of logging.

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Pulmonary Valvular Stenosis

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PULMONARY valvular stenosis, unassociated with other intra- and extracardiac lesions, constitutes approximately 10 per cent of all congenital cardiac malformations. The defect is successfully approachable by surgical means and is, therefore, of practical importance to the pediatrician. Fortunately, the obstruction to the outflow of the right side of the heart produced by the stenosis results in a somewhat characteristic clinical picture consisting of a harsh systolic murmur heard best at the pulmonary second sound, electrocardiographic evidence of right ventricular enlargement, and roentgenographic evidence of right ventricular enlargement associated with an enlargement of the main pulmonary artery and a decrease in the vascular shadow pattern in the lung fields.

No lesion spreaks more eloquently for the continued use of that "antiquated instrument," the stethoscope, than this, for the lack of symptoms in the usual case is striking. The following unusual case is reported to emphasize this point and to demonstrate again the ability of the human heart to preserve it's functional integrity in the face of tremendous disadvantages.

CASE REPORT

R. P. (No. 54-79618), a seven year old white boy, was admitted to Children's Hospital in Denver on July 12, 1954. The admission was prompted by the fact that the patient had a cardiac murmur which had first been noted during an upper respiratory infection at the age of ten months. The boy had a past history punctuated by the usual childhood illnesses and tonsillectomy, but in general was thought to be healthy. In the year previous to his admission, the parents thought they had noted some vague increase in fatigability and susceptability to "colds." They also had noticed a faint blue cast to the skin of the periorbital areas when the child had been playing a long time.

There had been no dyspnea on exertion, squatting, fainting or other symptoms referable to the cardiovascular system.

On physical examination, the patient was a cooperative boy who was believed to be fairly well developed and well nourished for his age. His blood pressure was 130/70 mm. Hg in both upper extremities. The femoral pulsations were good. His pulse rate was 130 per minute and his temperature was normal. There was no obvious cyanosis or clubbing of the fingers. The thorax was symmetric and the lungs were clear. The heart was enlarged to the left with the point of maximal impulse in the fifth intercostal space 1 cm. to the left of the mid-clavicular line. There was a palpable thrill over the precordium. A grade 4, harsh, systolic murmur was heard over the entire precordium with the maximum intensity in the pulmonary valve area. The murmur could also be heard well in the back. The pulmonary second sound was not split. The remainder of the physical examination revealed no abnormalities.

The routine laboratory tests were noncontributory.

The electrocardiogram revealed evidence of right ventricular hypertrophy. A cardiac diagnostic series including fluoroscopy, right and left obliques, and posteroanterior films revealed moderate cardiac enlargement, thought to be mostly the right ventricle. The main pulmonary artery was dilated and the pulmonary vascular pattern was less than normal. (Fig. 1.)

A tentative diagnosis of pulmonary valvular stenosis was made. On July 13, 1954, catheterization of the right side of the heart was accomplished without complications using a No. 5

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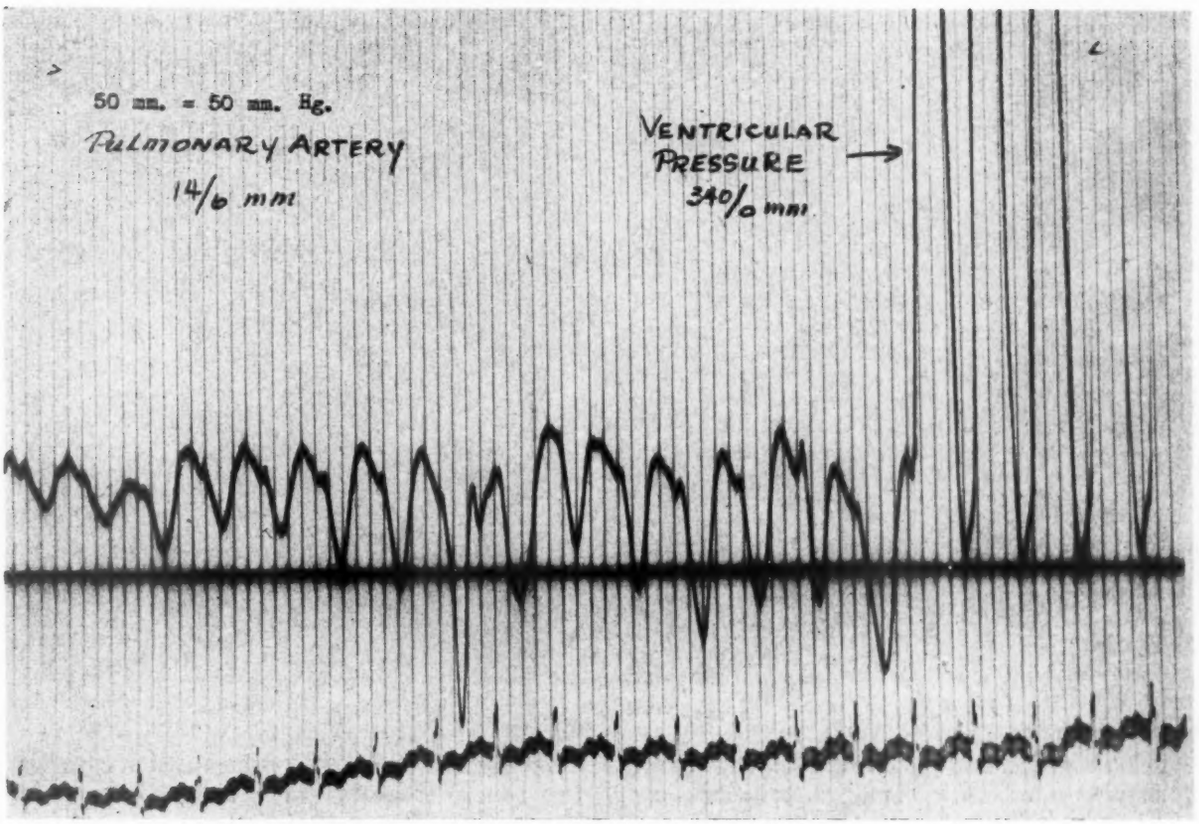

FIG. 1. Preoperative differential between pulmonary and ventricular pressures.

bird's eye catheter through the left median basilic vein. The data are given in Table 1.

On August 12, 1954, the patient was taken to surgery. He was anesthetized and placed in an ice tub where his temperature was reduced to 85°F. The chest was opened by an incision which followed the fifth rib and extended from one axilla to the other. The main pulmonary artery was dilated and a forceful "jet" could be felt with each systole. Pressure tracings were taken from the right ventricle and main pulmonary artery. The pressures were in the same range as those observed during catheterization of the heart.

Inflow-outflow occlusion was instituted, the pulmonary outflow tract was opened, and the grossly stenotic, cartilage-like pulmonary valve was removed. The total time of occlusion of the circulation was four minutes and the lowest temperature reached was 83°F. The remainder of the operation was uneventful.

The postoperative course was essentially uncomplicated and the patient was discharged on August 28, 1954.

Regarding the surgical specimen, the valvular tissue removed was very firm and grayish pink in color. Numerous yellowish plaques were noted on the endothelium. Microscopic examination revealed dense fibrosis with focal areas of degeneration and subendothelial hemorrhage.

TABLE 1
CATHETERIZATION OF RIGHT SIDE OF HEART BEFORE PULMONARY VALVULOTOMY

Position	Pressure (mm. Hg)	Oxygen Saturation (%)
Right pulmonary artery	14/6	64.0
Right ventricle	340/0	66.0
Right auricle	.....	62.8
Left brachial artery	112/72	91.0

In August, 1955, one year after surgery, the patient was readmitted for evaluation. He had done well at home and no symptoms had been noted save for mild dyspnea on heavy exertion. The parents stated that he had been very active and had grown. Physical examination

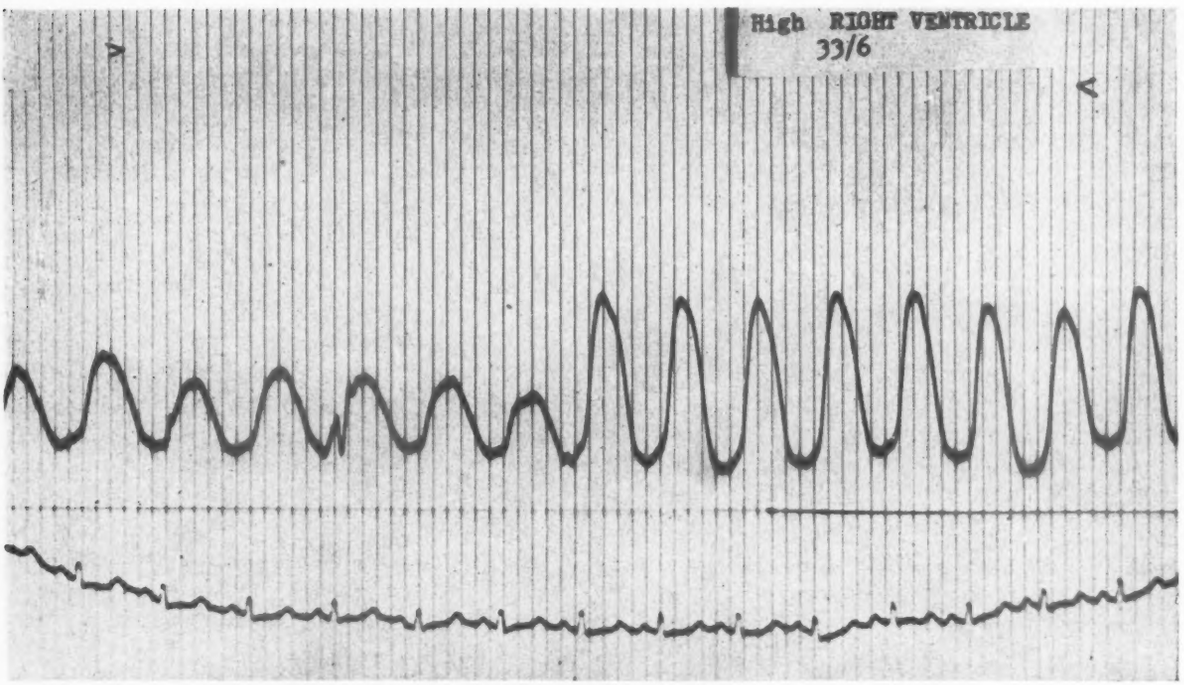

FIG. 2. Postoperative tracings showing marked reduction in systolic gradient.

revealed a grade 4 systolic murmur in the pulmonary area and a soft, early, diastolic murmur in the same location.

Electrocardiography revealed right ventricular hypertrophy. No significant further enlargement of the heart could be detected on x-ray. (Fig. 2.)

TABLE II
CATHETERIZATION OF RIGHT SIDE OF HEART AFTER PULMONARY VALVULOTOMY

Position	Pressure (mm. Hg)	Oxygen Saturation (%)
Right pulmonary artery	19/7	71.0
Main pulmonary artery	29/4	....
High right ventricle	33/6	....
Low right ventricle	45/3	68.8
Right auricle	....	69.8

A repeat catheterization of the right side of the heart was performed. (Table II.)

COMMENTS

The right ventricular hypertension of 340 mm. Hg which this patient had before surgery was the highest we had ever seen in this laboratory, and search of previous reports in the literature failed to reveal any other cases in this range. It was almost incredible that the heart was able to continue its work without failure under such stress, and it is noteworthy also that the tricuspid valve had remained competent. How long such a status could exist without failure is, of course, unknown, but it appeared only logical to us that this was to be classed as a surgical urgency if not emergency. The reduction in the level of pressure was to be expected following surgery although most of the cases at this hospital in which recatheterizations have been performed have not shown such a marked reduction in one year's time.

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Malignant Leiomyoma of the Jejunum

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Malignant tumours of smooth muscle arising in the intestine are very rare. Golden and Stout [1] examined the records of the Presbyterian Hospital, New York, for the years 1913 to 1940, and found sixty smooth muscle tumours, of which twenty-one were malignant. Only one tumour of the sixty was found in the jejunum. The following case report is, therefore, of considerable rarity.

CASE REPORT

A sixty-seven year old woman was admitted to the hospital with a history of epigastric pain and nausea of seven weeks' duration. The pain usually began just after a meal but not always. She passed black stools at about the time the pain began but not subsequently. Her bowel movements during these seven weeks became progressively less frequent.

Physical examination revealed a large, smooth, central abdominal tumour. The spleen was palpable and tender. The liver could not be felt.

The blood pressure was raised (160/100 mm. Hg). There was an apical systolic bruit accompanied by a thrill, and the fundus of the left eye showed an ill-defined white area thought to be due to a past hemorrhage.

At laparotomy the tumour was found to have a smooth surface with several cyst-like projections. Similar cystic masses were lightly adherent to the free border of the intestine. Normal jejunum entered the mass 15 cm. from the duodenojejunal junction and emerged from the opposite side of the tumour. No secondary deposits could be found in the liver but the pelvis was studded with them.

The small intestine below the tumour was divided, the mesentery was divided down to its root and, together with the tumour, was freed from the posterior abdominal wall. The stump of the lower portion of jejunum was oversewn and joined with the stump of the upper portion in an end-to-side anastomosis. The anastomosis was then anchored to the posterior abdominal wall.

For pathologic examination, the tumour, which measured 24 by 24 by 10 cm., was split in half. It was then found that its outer coat was the serous coat of the intestine, within which was soft white growth up to 10 cm. thick. The inner part of the mass was necrotic, friable and blood-stained, and it was evident that the continuity of the lumen of the intestine had only been preserved by the breaking away of friable tumour tissue. The firmer portion of the tumour was broken up into lobules by massive extravasations of blood, and the same conditions were found in the cyst-like bodies attached to the mesentery, the largest of which was a pedunculated oval mass, 7.5 cm. long. The extravasated blood gave the appearance of a succession of blood cysts.

The normal intestine entering the mass was almost fully obstructed by a pedunculated tumour mass 3 cm. long, which was probably the principal cause of the pain.

For histologic examination, so much of the tumour tissue was necrotic or replaced by haemorrhage that repeated sections were necessary to establish a diagnosis. There were two distinct types of tissue. In the first, long spindle cells were arranged in whorls, giving a close resemblance to the ordinary benign uterine fibroid. Some of these areas contained clusters of cholesterol clefts suggesting that this part was of considerable age. Around these zones was highly cellular tissue with no structural arrangement and no cell differentiation. Cell nuclei were hyperchromatic and showed frequent mitoses.

The blood vessels in the benign parts were well formed. Those in the malignant parts were large clefts in the tumour tissue and there was much extravasation of blood around them.

It was concluded that this was a malignant degeneration of a long-standing leiomyoma.

COMMENTS

The one case in Golden and Stout's series which can usefully be compared with ours (Case IX) was that of a white American man, aged sixty, admitted to the hospital with a three-day history of tarry diarrhea and fainting spells associated with weakness. He had previously been well. Physical examination revealed no abnormalities other than a grave anaemia. He was treated for this with transfusion and was discharged; however, he was readmitted on two further occasions during the next five weeks. Operation was then performed and a bilobed tumour, 5 cm. long, was found on the free edge of the jejunum, 2 feet from the duodenum. At one end of its attachment the mucosa was ulcerated, the origin of the haemorrhage. The patient was in good health eight years after resection of the growth.

The only features common to this case and ours are the short period of illness and the melaena. It is remarkable that in our case the tumour grew to such a large size before haemorrhage into the intestine occurred.

Willis [2] describes a rectal tumour with the same histologic features as ours, namely, partly well differentiated leiomyomatous structure and partly disorderly pleomorphic cell sarcoma. The growth was inoperable and only palliative colostomy could be performed.

According to Golden and Stout, the prognosis in this type of tumour of the intestine is largely dependent on the anatomic site. If the organ is fixed, excision is dangerous or impossible. If the organ is mobile, as in the stomach and intestine, the growth is restricted for a long time by the barrier of the peritoneum, and excision is not only possible but also likely to be successful. In our case the pelvic metastases precluded such a hopeful outlook.

Acknowledgment: We are indebted to Dr. Joseph Adler for helpful criticism and advice.

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Free Perforation of a Jejunal Ulcer Following Vagotomy and Gastroenterostomy

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THE incidence of free perforation of jejunal ulcer following gastroenterostomy is reportedly low. Walters, Chance and Berkson [*1*] reported only two acute perforations in a series of 301 marginal ulcers. We can find no cases reported of free perforation following the combined procedure of vagotomy and gastroenterostomy. It is thought that this report might be of particular interest in view of the common employment of vagotomy as a therapeutic procedure in the treatment of both duodenal and marginal ulcers. It is also believed that the specific mode of therapy applied in this instance, namely, subtotal gastrectomy and resection of the gastroenterostomy, despite its magnitude under emergency conditions, was nevertheless the most suitable both for immediate and long range ulcer management in a patient who had already demonstrated a marked ulcer diathesis. The feasibility, under certain conditions, of primary gastrectomy as the initial treatment of perforated duodenal ulcer has been demonstrated [*2–5*]. This attitude has not been accepted as a routine measure in all perforated ulcers on several counts: it would entail the removal of two-thirds to three-quarters of the stomach in a number of patients who might have gone through life following a simple plication procedure with no, or minimal, gastric symptoms; the risk, even in patients seen early, would be unduly high in the hands of many surgeons called upon to treat perforated ulcers. It was believed, however, that the patient herein described had already amply demonstrated an ulcer diathesis of such marked degree that only by radical measures could relief be anticipated.

CASE REPORT

A twenty-four year old white man was admitted to the Wilkes-Barre Veterans Administration Hospital via ambulance at 1:30 P.M., October 13, 1955, complaining of severe, generalized abdominal pain.

The past history revealed that on September 9, 1952, following a two-year history of epigastric distress, the patient underwent emergency laparotomy and plication of a perforated duodenal ulcer while serving with the U. S. Army in Korea. Subsequently, episodes of severe upper abdominal pain recurred, at first relieved by the intake of food, but later unrelieved and associated with vomiting and melena. On February 24, 1955, at another institution, gastrojejunostomy and bilateral subdiaphragmatic vagotomy were performed. A postoperative Hollander test revealed a fairly high basal free acidity of 63 units, but a satisfactory drop to levels of 33 and 14 units following the administration of insulin with concomitant blood sugar levels of 27 and 36 mg. per cent. At about the same time, a histamine test had produced a rise in free gastric acidity from a fasting level of 84 units to 108 units. A postoperative gastrointestinal series noted "remarkably little peristalsis."

Following this procedure the patient did well, gained weight and was able to return to his occupation as a general laborer. However, approximately two weeks prior to his present admission, he again began to experience abdominal pain which was mild in degree and did not prevent him from working. On the morning of admission, while at work, the patient suddenly experienced severe, prostrating abdominal pain, which began in the left lower quadrant but soon spread throughout the entire abdomen and radiated to the shoulders.

FIG. 1. Photograph of resected specimen showing perforated ulcer of jejunum adjacent to gastrojejunostomy stoma.

FIG. 2. Postoperative roentgenogram showing subtotal gastrectomy with normally functioning gastrojejunostomy.

On admission to the hospital, physical examination revealed that the patient appeared acutely ill and complained of severe pain on the slightest motion of his body. His temperature was 97.4°F., blood pressure was 105/75, and pulse 72. The abdomen exhibited a board-like rigidity and the well healed scar of the previous gastric surgery.

Laboratory and x-ray studies were as follows: urinalysis, no abnormalities; hemoglobin, 16.4 gm. per cent; red blood cells, 5.4 million per cu. mm.; white blood cells, 11,800 per cu. mm. with 80 per cent neutrophils. Upright chest plate was negative for free subdiaphragmatic air.

As soon as the initial work-up was completed and blood became available, exploration was performed with the patient under general anesthesia. A free perforation of a jejunal ulcer was found, located anteriorly on the efferent loop and just distal to the site of anastomosis. The gastrojejunostomy was located at the most dependent portion of the stomach, rather than at the antrum; it was antecolic and short-limbed. The peritoneal cavity contained several hundred cubic centimeters of cloudy fluid and showed evidence of early, acute peritonitis; however, there was no large collection of gross food particles. Because of the patient's generally good condition and his marked ulcer diathesis, it was elected to proceed with definitive surgery in the form of subtotal gastrectomy. This was performed without undue difficulty; in fact, it was believed that the previous vagotomy contributed to the mobility of the stomach. Figure 1 is a photograph of the fixed specimen. An estimated 75 to 80 per cent of the stomach was removed. The gastrojejunostomy was also resected and continuity of the intestine was re-established by end-to-end jejunojejunostomy and a Hofmeister-Polya gastrojejunostomy distal to the jejunojejunostomy. Prior to the completion of the anastomoses, the previously inserted nasogastric tube was led through both anastomoses to provide decompression of the proximal loop. The patient received a total of 1,000 cc. of whole blood during the operation which he tolerated very well.

The patient's convalescence from this emergency surgery was completely uneventful and his care was similar to the authors' routine for elective gastrectomy cases. Figure 2 shows the roentgenographic appearance of the stomach at the end of the third postoperative week. A

Hollander test, performed during the fourth postoperative week, revealed a basal acidity of 10 units of free HCl, which fell to zero and remained there after an insulin-induced hypoglycemia of 19, 28, 40 and 47 mg. per cent blood sugar (specimens taken at half-hour intervals). Two days later the patient demonstrated adequately functioning, acid-producing mucosa by a histamine test, which produced a rise in free acid from a basal fasting free acidity of 5 units to 30 units forty-five minutes after the injection of the drug.

The patient subsequently returned with an annoying and fairly typical "dumping syndrome." After failure of the usual measures of treatment both at home and in the hospital, relief was obtained on low doses of chlorpromazine.

The patient was last contacted June 27, 1956, eight months after his gastrectomy. He is working full time as a salesman and has so far regained 2 pounds of his weight. He complains of only occasional distress, but continues to take chlorpromazine.

COMMENTS

The use of the Hollander test to determine the completeness of vagotomy is admittedly fraught with considerable confusion and error. In this case, however, the postoperative Hollander test at the hospital where the previous vagotomy and gastroenterostomy had been performed, together with the Hollander test at this institution following gastrectomy, seemed to indicate a complete vagotomy. It is believed that the results cited meet the criteria of a negative insulin test as outlined by Weinstein et al. [6], as well as Walters, Belding and Lillie [7]. The possibility of a negative test as a result of gastritis and excessive mucous secretion seems to have been eliminated by histamine tests which were performed at about the same time as the Hollander tests, and which demonstrated a good rise in gastric acidity following subcutaneous administration of the drug. The paucity of peristalsis demonstrated by a gastrointestinal series following the gastroenterostomy and vagotomy tends to confirm these tests of the completeness of the vagotomy.

It is also of interest to note that the emergency surgery, consisting of high resection of the stomach with attached stoma and jejunal segments followed by jejunojejunostomy and gastrojejunostomy, was readily and easily accomplished and was not accompanied by any evidence of shock as a result of the gross peritoneal insult and the extensive surgery. Had the intra-abdominal injury been older, or had the peritoneal contamination been more extensive, we believe that more conservative surgery would have been indicated as the primary mode of therapy.

SUMMARY

1. A case is presented of free perforation of a jejunal ulcer following vagotomy and gastroenterostomy.

2. The emergency was successfully managed by subtotal gastric resection, resection of the anastomotic loop, gastrojejunostomy and jejunojejunostomy.

3. An otherwise intractable "dumping syndrome" that followed this surgery has been successfully managed by the administration of a maintenance dosage of oral chlorpromazine.

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BOOK REVIEWS

Campbell's Operative Orthopedics. By J. S. Speed, M.D., Editor, and Robert A. Knight, M.D., Associate Editor. Third edition, two volumes; 2,124 pages, 1,323 illustrations including two color plates, with author and subject indexes and references at chapter endings. St. Louis, 1956. C. V. Mosby Co. *Price* $40.00.

In publishing the third edition the Editor says that it is only after thoroughly surveying the orthopedically related literature of the post-war years that one becomes truly aware of the innumerable changes that have taken place in their specialty in the past ten years. In this edition, in addition to incorporating much of the new material and deleting many outmoded methods and ideas, greater emphasis is given to the fundamentals, particularly with regard to indications and contraindications for operation and in the choice of the proper operative procedure when more than one method is available. In many places the authors have indicated their own preference as to surgical physiology, and also surgical approaches have been enlarged. Prosthetic replacement and arthroplasty have been considered in appropriate chapters. The chapter on peripheral nerve surgery has been thoroughly revised, incorporating the experiences of the American and British army medical corps. Amputation surgery has been presented with due consideration to civilian problems. The section on inverted vertebral discs has been revised to include modern diagnostic considerations and present day operative technics.

Needless to say, this is a valuable addition to the hospital or operating room library.

T. S. W.

Clinical Roentgenology of the Digestive Tract. By Maurice Feldman, M.D. Fourth edition, 776 pages, illustrated, with an index. Baltimore, 1957. Williams & Wilkins Co. *Price* $15.00.

Dr. Feldman's text represents a genuine revision of the previous edition published in 1947. The book accomplishes its stated purpose of covering the field of "diagnostic roentgenology of the digestive tract" in a comprehensive fashion. One finds many entities not usually included in the standard texts on this subject.

This reviewer found the use of a bibliography following each entity to be advantageous. The sections on the stomach, duodenum and colon are particularly good. The sections on the liver, pancreas and peritoneum suffer somewhat by comparison.

Most of the illustrations are excellent but a few have been carried over from the previous edition and need replacing.

All in all, the pros far outweigh the cons, and the book is recommended to all interested in gastroenterology.

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1. Spencer, H.; Berger, E.; Charles, M.; Gottesman, E. D., and Laszlo, D.: Effects of 17-alpha-Ethyl-17-Hydroxy-Norandrostenone, Proc. Am. A. for Cancer Res. *2*:149 (April) 1956.

2. Proceedings of a Conference on the Clinical Use of Anabolic Agents, Chicago, Illinois, Searle Research Laboratories, April 9, 1956.

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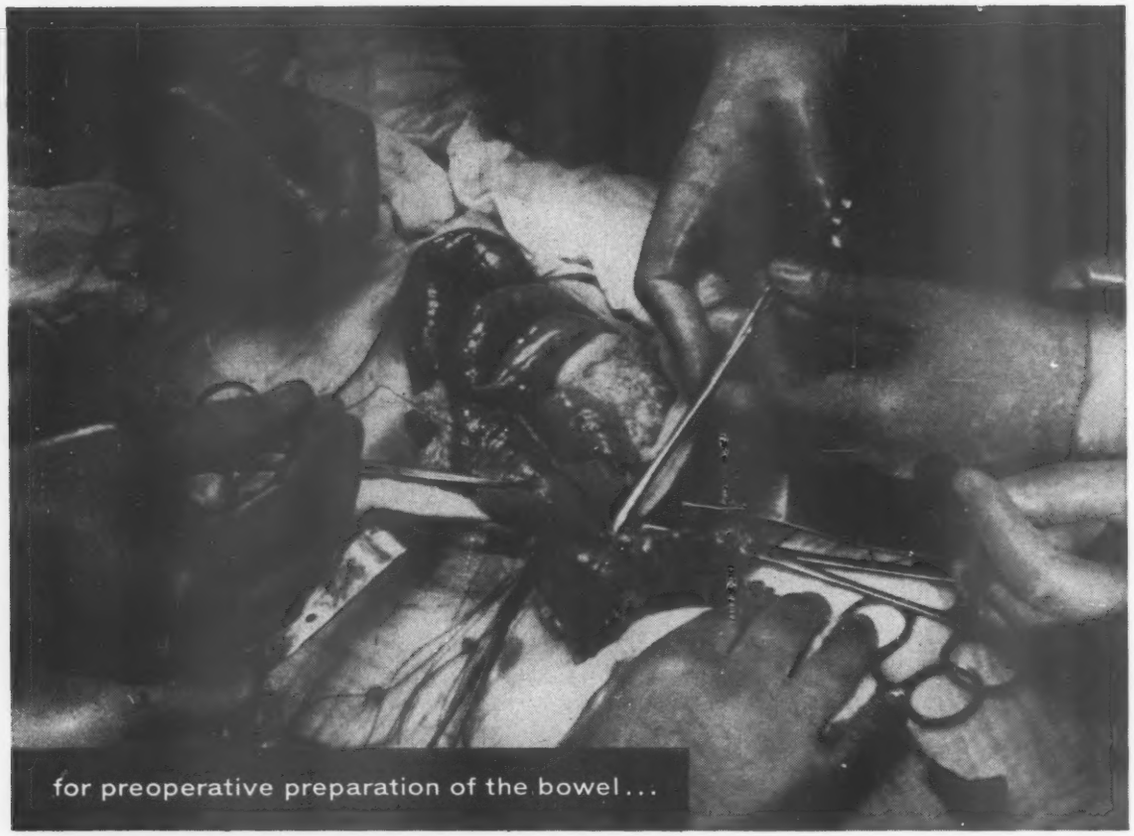

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1. Boger, W. P.; Strickland, C. S.; and Gylfe, J. M.: Antibiot. Med. & Clin. Ther. 3:378 (Nov.) 1956.

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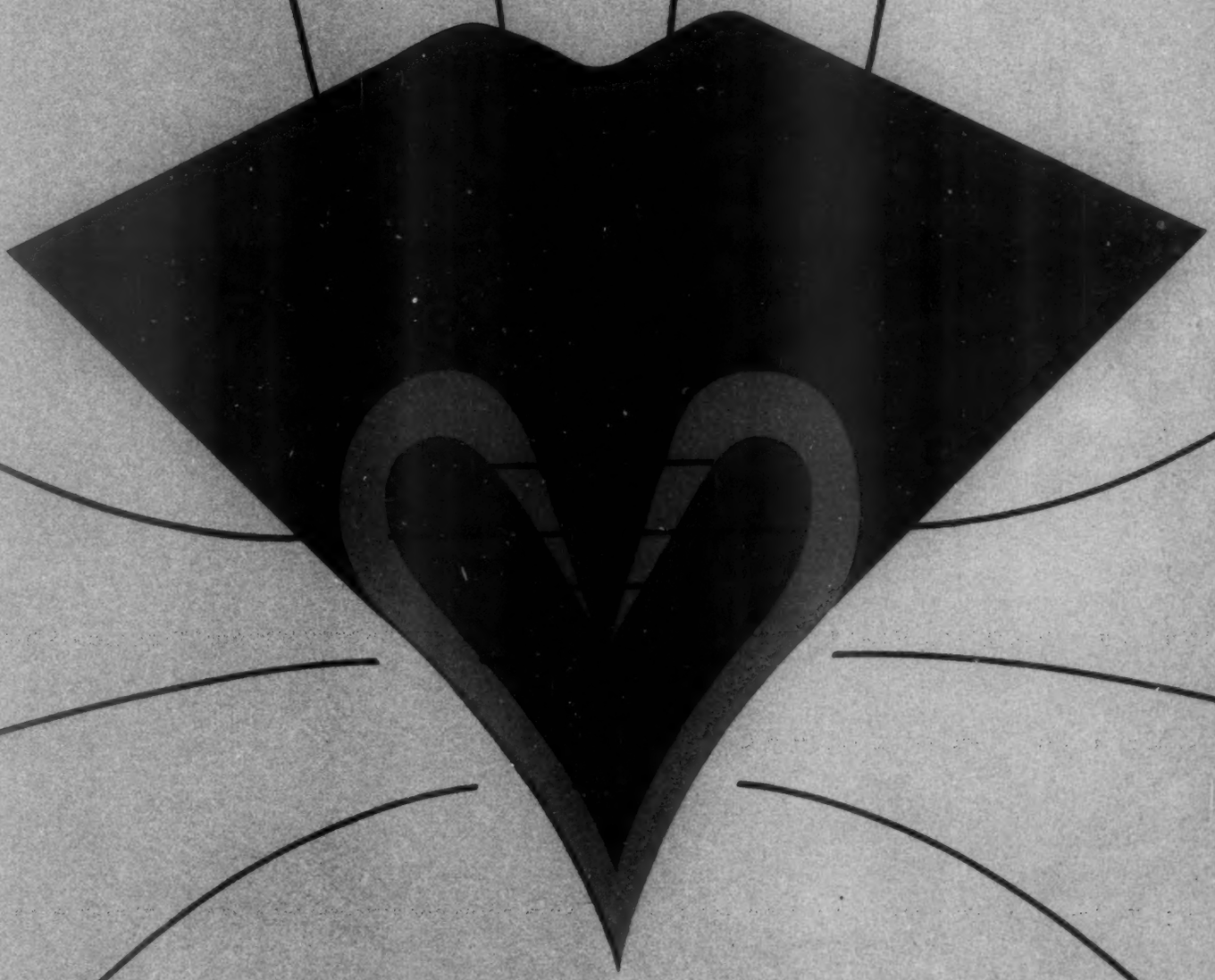

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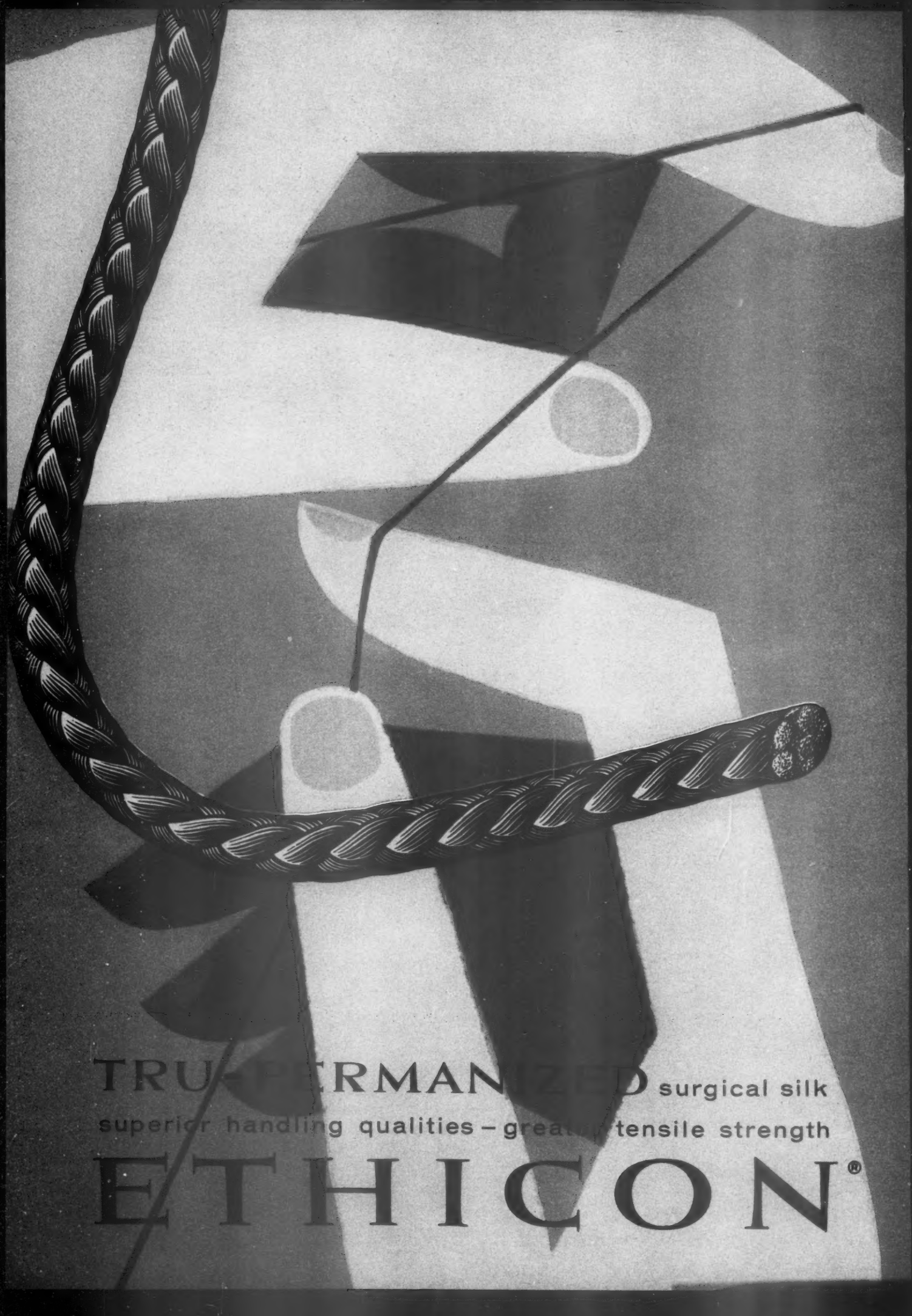
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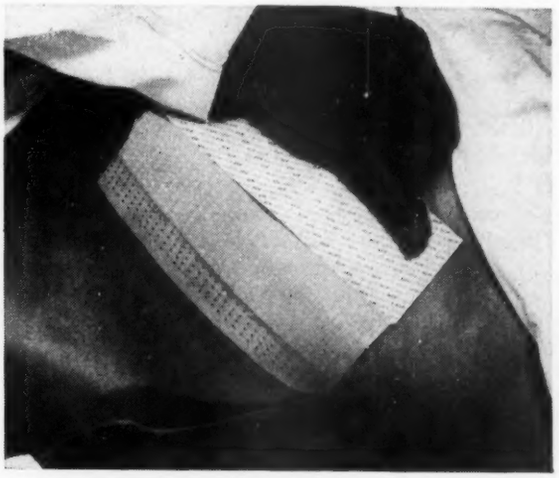

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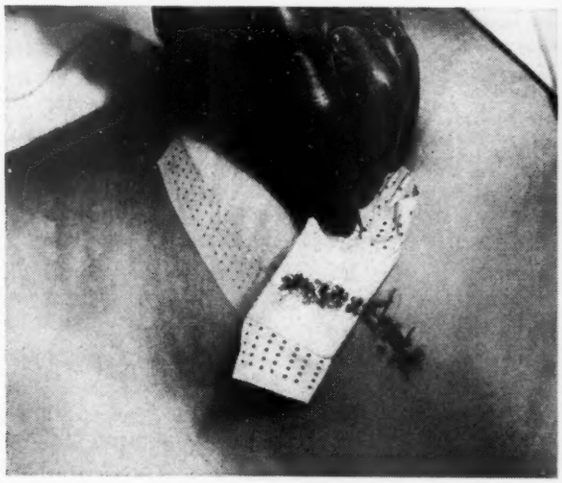

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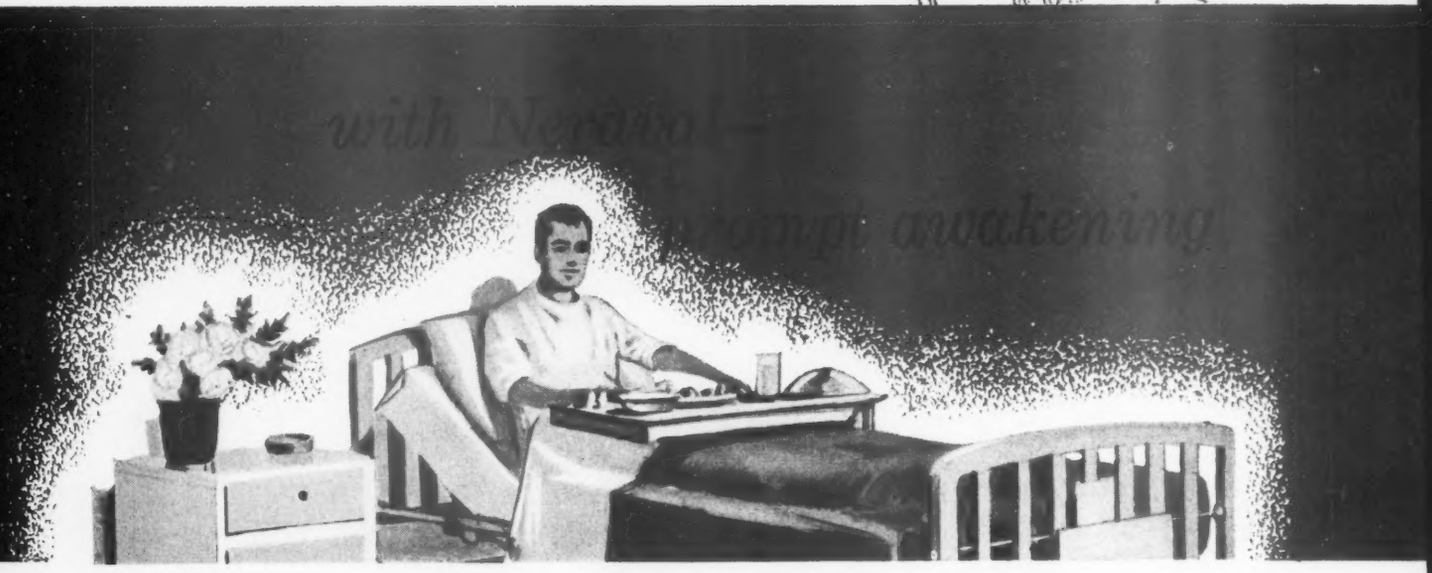

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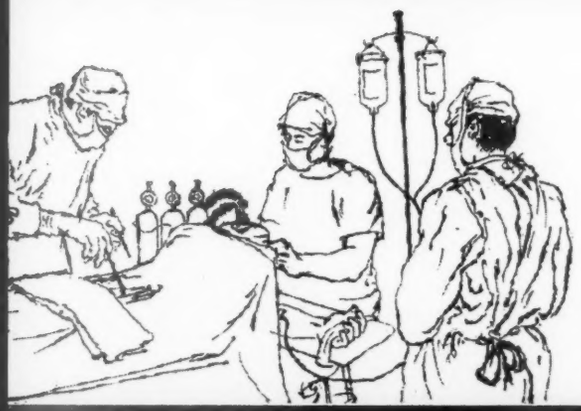

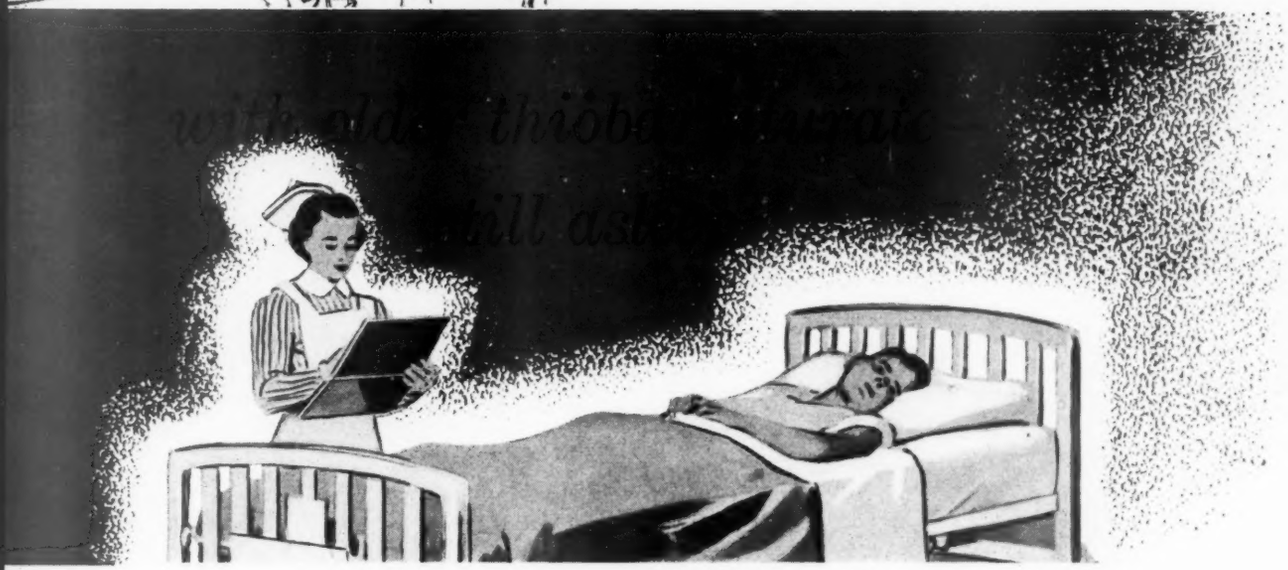

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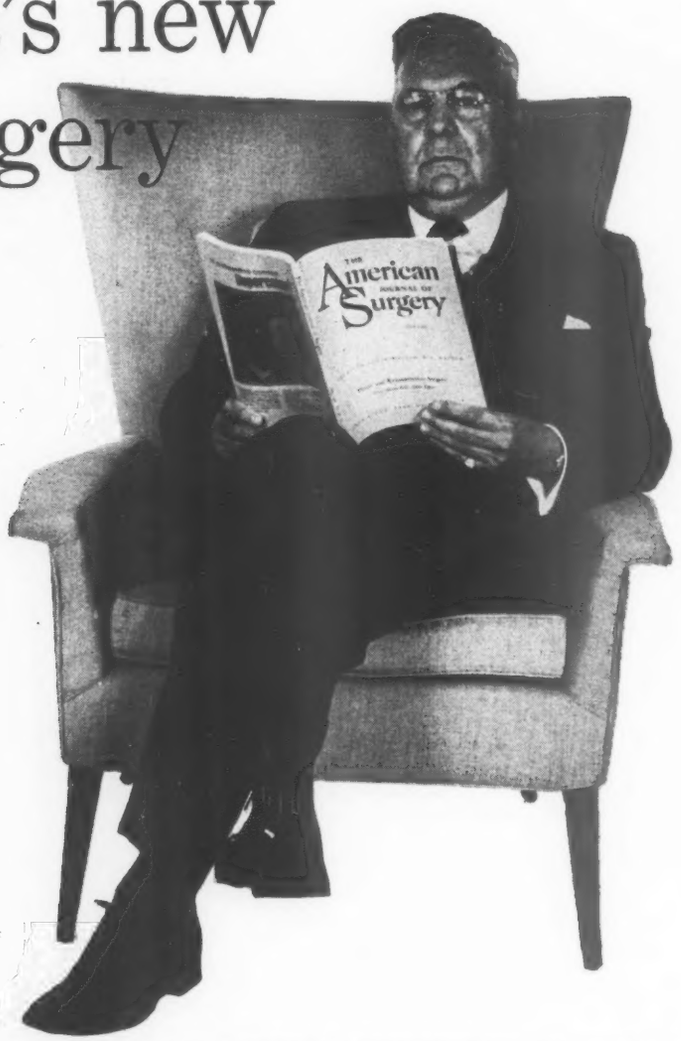

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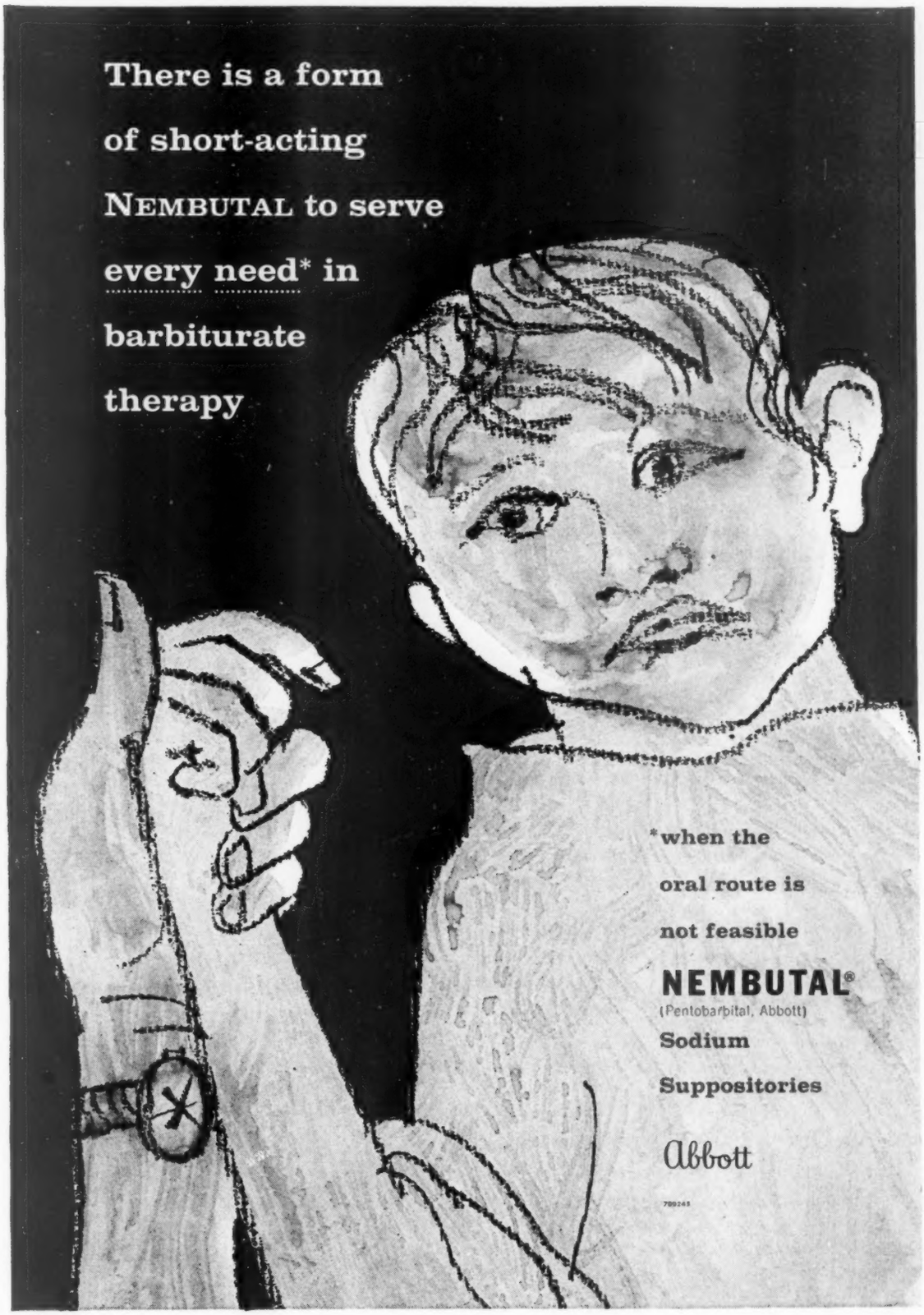
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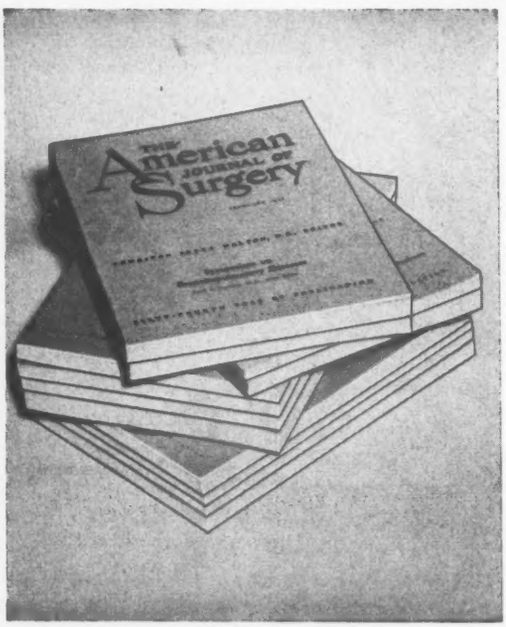

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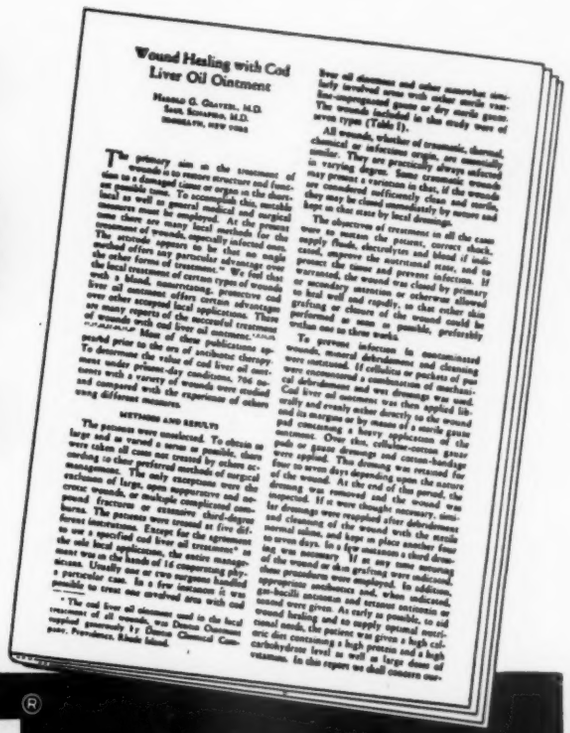

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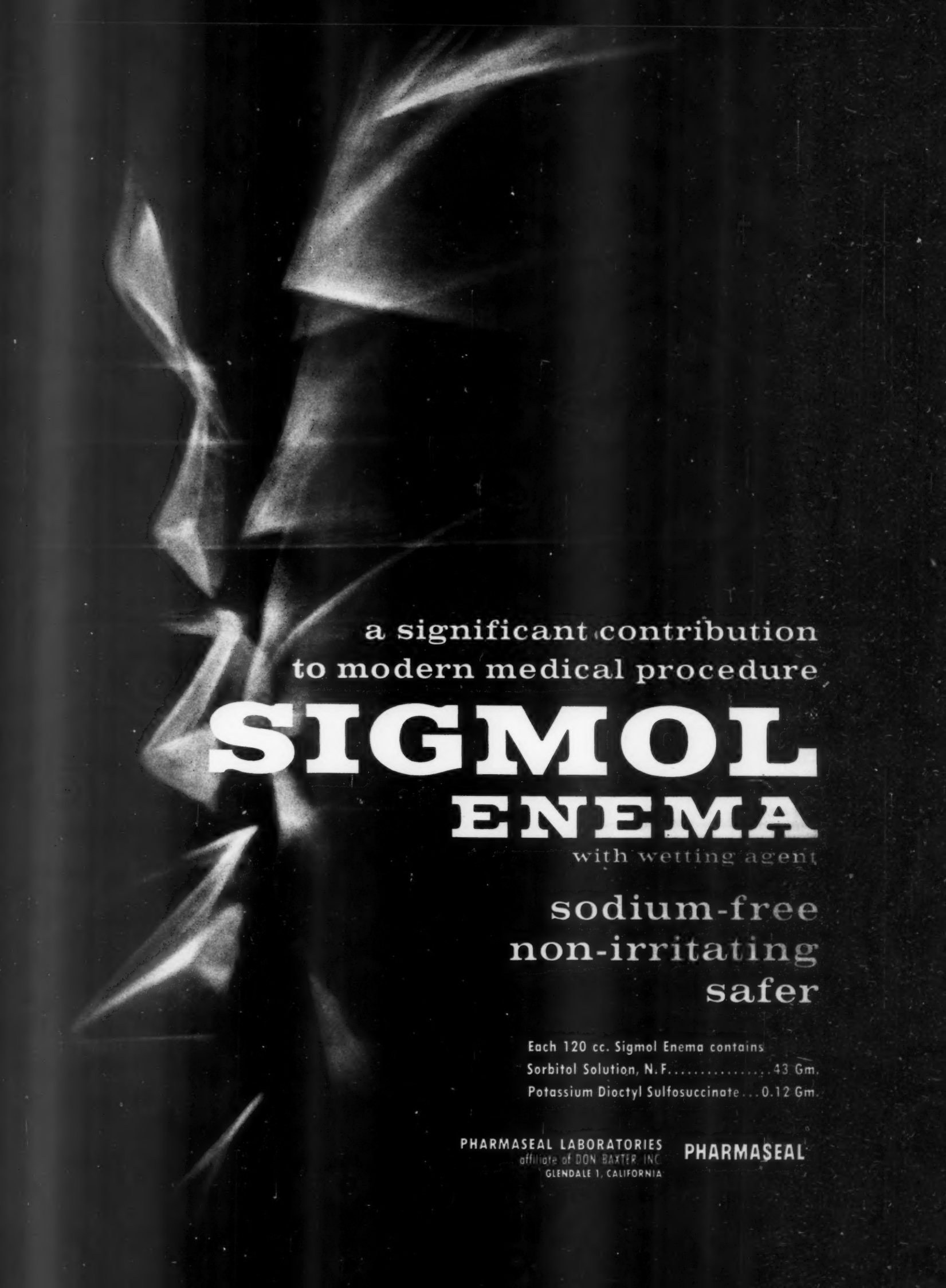
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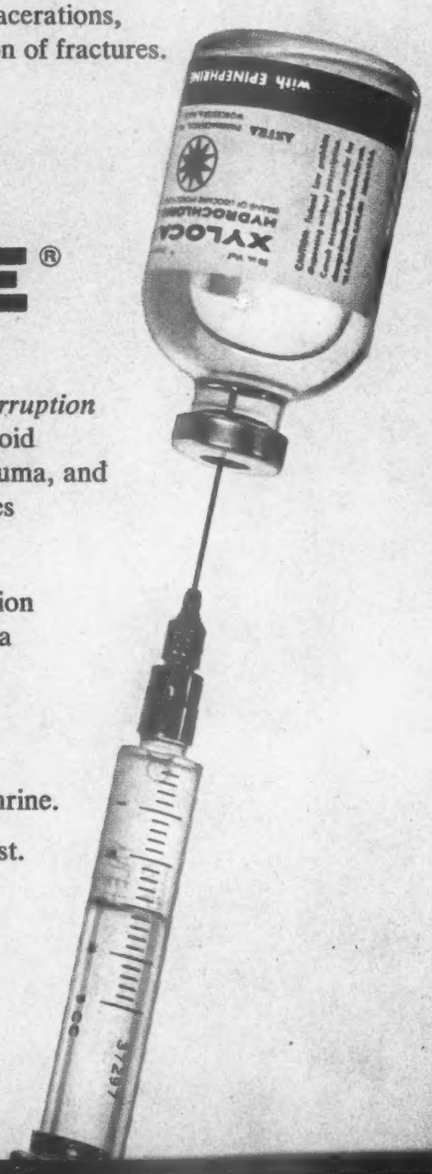

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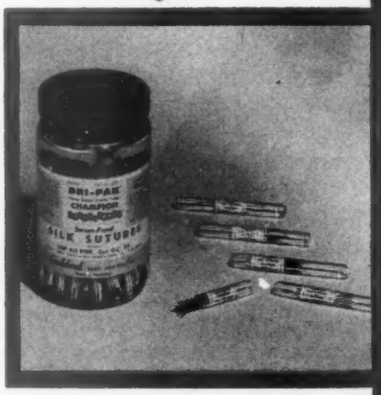

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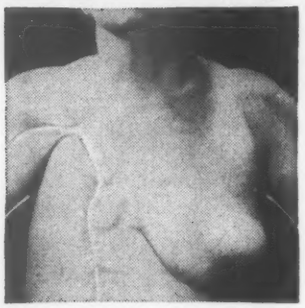

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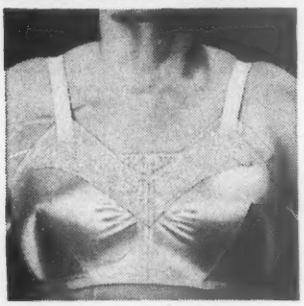

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NOTES AND QUOTES

GETTING married and raising a family has become increasingly popular among the younger set, according to statisticians of the Metropolitan Life Insurance Company.

Since World War II, the median age at first marriage has decreased by one and one-third years, the statisticians point out, and now stands at twenty-three years for men and twenty years for women. As a result, the married population at the younger ages has increased markedly, and there are now more than one and one-half times as many married men under age twenty-five as there were in 1940.

Equally noteworthy is the increase in the proportion of young couples with children, reflecting largely the baby boom incidental to World War II and its aftermath, the statisticians say. The number of births in the United States has reached a new high in each of the last six years, the 1956 figure being more than 4,200,000 compared to 2,560,000 in 1940.

Relief from adverse penicillin reactions, estimated to affect a minimum of 600,000 persons annually, may be available before the end of this year.

Two Midwest physicians, in papers presented at the American Medical Association convention recently, reported highly successful results in the treatment of penicillin reactions by the injection of a newly developed penicillinase. Capt. G. M. Davis, M.C., U.S. Navy, of Great Lakes Naval Training Station, and Dr. R. M. Becker of Madison, Wisconsin, each reported that in a significant number of clinical tests allergic manifestations of penicillin reactions promptly receded following the injection of penicillinase.

Dramatic relief occurred within a period ranging from a few hours up to twenty-four hours, and most patients had complete freedom from itching and swelling in twenty-four to seventy-two hours, they reported. An additional advantage of the new therapy is the absence of recurrence of symptoms even when other supportive therapy is stopped.

For these reasons, Dr. Becker told his A.M.A. audience, "penicillinase should be kept on hand in every doctor's office or hospital where penicillin is administered."

Informed pharmaceutical industry sources estimate that at least 60 million courses of therapy of penicillin and penicillin combined with other antibiotics will be administered this year in the United States. This amounts to a course of therapy for slightly more than one of every three persons in the country.

Allergic or other reactions to this penicillin therapy occur in from 0.5 per cent to as high as 5 per cent of the patients receiving penicillin. The nature and severity of the reactions in part depend upon the amount and type of penicillin administered, the method of administration and certain other considerations.

If the "average" incidence of penicillin reaction is estimated at only 1 per cent of the total number of courses of treatment given this year, there will be 600,000 patients showing varying reactions ranging from annoying rashes up to severe shock, and even death.

On the basis of the current findings, speedy relief from these adverse reactions may be anticipated when Schenley Laboratories introduces penicillinase to the medical profession under the trade name neutrapen® before the end of this year. Neutrapen, or injectable penicillinase, is a highly refined enzyme produced by Schenley Laboratories by a method covered by a pending patent.

THE AMERICAN UROLOGICAL ASSOCIATION offers an annual award of $1000 (first prize of $500, second prize $300 and third prize $200) for essays on the result of some clinical or laboratory research in urology. Competition shall be limited to urologists who have been graduated not more than ten years, and to hospital internes and residents doing research work in urology.

The first prize essay will appear on the program of the forthcoming meeting of the American Urological Association, to be held at the Roosevelt Hotel, New Orleans, Louisiana, April 28–May 1, 1958.

For full particulars write the Executive Secretary, William P. Didusch, 1120 North Charles Street, Baltimore, Maryland. Essays must be in his hands before December 1, 1957.

Cancer is "vulnerable" and already is "yielding here and there" to those who are fighting it, according to an opinion expressed by Dr. John R. Heller, Director of the National Cancer Institute, Public Health Service, Department of Health, Education and Welfare, in a paper presented

CONTINUED ON PAGE 48

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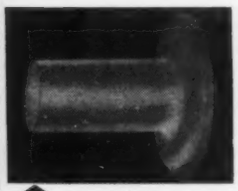

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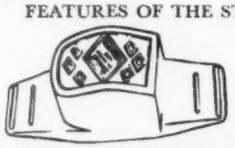

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NOTES AND QUOTES

before the 23rd annual meeting of the American College of Chest Physicians in New York City.

"Cooperative effort" in research was given the principal credit by Dr. Heller for the headway made against cancer, which is man's second disease enemy, being exceeded only by heart disease in number of deaths caused.

New and refined research technics and instruments developed rapidly by this cooperative effort since World War II have begun to produce important results in fighting cancer, Dr. Heller continued.

"These include," he said, "supervoltage generators, radioisotopes, the electron microscope, and other electronic devices, inbred strains of mice, tissue culture, chromatography, mass spectrograph, and, most recently, an ultraviolet television camera-microscope, to name just a few.

"In addition, development of the new concept of molecular biology has brought the precise techniques of biochemistry to the characterization of cell processes in terms of molecules and their chemical interactions.

"Cancer research is financed by cooperative funds, coordinated by cooperating organizations, and performed by cooperating skills. In fact it is not science in itself, but the simultaneous activity of many independent scientific disciplines."

IN an unusual operation, doctors at the Veterans Administration hospital in Cleveland have saved a veteran from eventual blindness by substituting part of the moisture supplied to the mouth in place of the moisture which his tear glands would no longer produce.

By transplanting the parotid duct, they changed the flow of a fluid from the mouth to the eye and halted a condition in which the eye was drying up toward sightlessness. The parotid duct is a tube-like passage in the cheek.

Although records show similar rare operations were performed in Russia and China, this American case is unique since the first surgery was followed by a second operation to alleviate excessive moisture in the eye. The combined surgery, according to Dr. John E. L. Keyes, area consultant to the V. A. in Ohio and adjoining Midwestern states, may well never have been performed before.

Both operations were performed by Dr. James E. Bennett, attending ophthalmologist at the Cleveland V. A. hospital, assisted by Dr. Arby L. Bailey, chief resident in ophthalmology at the same hospital.

Scientists at the Rockefeller Institute have developed a new instrument which harnesses the technics of color television and ultraviolet microscopy to provide information about living cells which is not otherwise available. The image produced by ultraviolet radiation is viewed on a modified color television receiver.

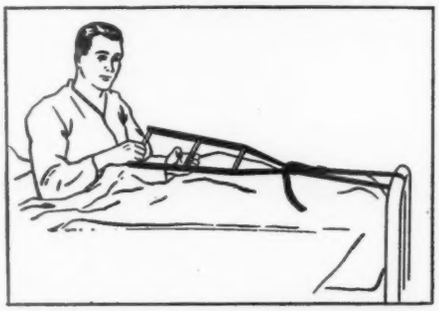
Called an ultraviolet, color-translating television microscope, or UCTM, the instrument will enable cell biologists and chemists to see instantly differences in cell structure and chemistry. Because ultraviolet is beyond violet and is invisible to the human eye, it has to be translated to visible light by means of color television.

This development was described at a lecture before the faculty of the Rockefeller Institute by Dr. Vladimir K. Zworykin, Director of the Institute's Medical Electronics Center and Honorary Vice President of the Radio Corporation of America. Dr. Zworykin had worked on this problem at the RCA Laboratories prior to joining the Institute staff as an affiliate, and for the past two years has been assisted at the Institute in New York by Fred L. Hatke and recently by Carl Berkley. This device has been made possible by the technics developed for color television and by the cooperation of the RCA Electron Tube Division in building special high sensitivity camera tubes for the ultraviolet.

A MAJOR search for anticancer compounds is underway at Stanford Research Institute. The $450,000 per year research effort in collaboration with the Sloan-Kettering Institute for Cancer Research, New York City, is supported by the Cancer Chemotherapy National Service Center, National Institutes of Health, Bethesda, Maryland, and Stanford Research Institute.

Some twenty-five members of Stanford Research Institute's Physical Sciences Division are engaged in the program to develop drugs which are highly effective against cancer cells but are not toxic to other cells of the human body. The goal is a drug which will seek out and destroy cancer cells which have spread widely throughout the body.

For Patient Protection



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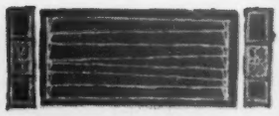

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Temperature - Pulse - Respiration

Edwards Dra (Mrs.)
PATIENT'S — MAIDEN LAST NAME — FIRST NAME

5'7-814
HISTORY NUMBER

Pleurisy, diaphragmatic

6-E Medical 1/28/57
LOCATION — SERVICE — DATE

F	72	M S W D Sep
Sex	Age	Marital Status

Month February

Day of month	7	8	9	10	11	12	13
Day after admission	9	10	11	12	13	14	15
Day after							
Hour of day	4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12						

Temp. F / Pulse

107 — 160
106 — 150
105 — 140
104 — 130
103 — 120
102 — 110
101 — 100
100 — 90
99 — 80
98.6
98 — 70
97 — 60
96 — 50
95 — 40

Respiration: 20 ... 20 ... 16

Blood Pressure: 160/90 ... 130/90

Height 5'4" Weight: 112 lb. ... 115 lb.

Total fluid intake by mouth: one lit.

Total fluid intake by all other routes

Total voided out-put

Total Urine Drainage

Stools: ✓ ✓ ✓ ✓ ✓

Drainage

Sputum

Diet: Reg. Reg. Reg. Reg. Reg. Reg. Reg.

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ONSET: 15 to 30 minutes.

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DOSAGE FORMS: Syrup (15 mg/5 cc); expectorant (15 mg Romilar and 90 mg NH_4Cl/5 cc); tablets (15 mg).

DOSAGE	1 to 4 times daily
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SUPPLY: Romilar Syrup, butterscotch-flavored, is supplied in bottles of 4 and 16 oz. Romilar Expectorant, fruit-flavored, is supplied in bottles of 16 oz. Romilar Tablets, sugar-coated, are supplied in packages of 20 and 100.

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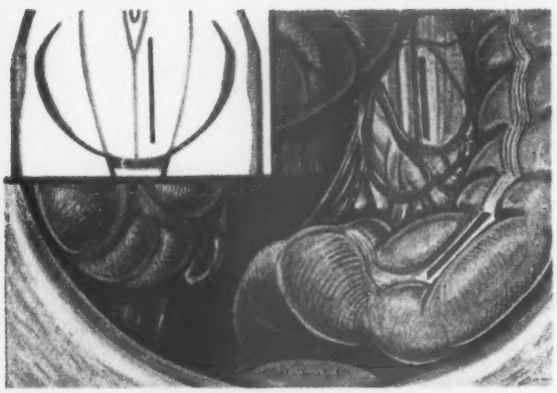
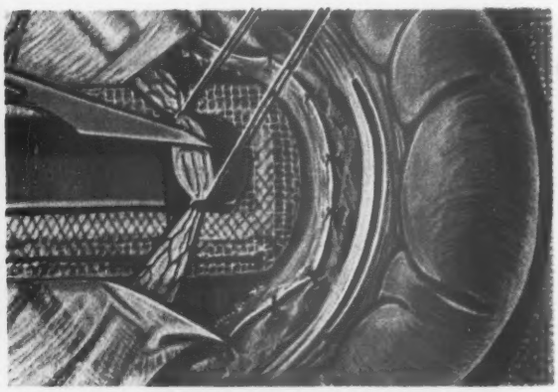
KEY ADVANCES IN OPERATIVE TECHNICS*—*Uretero-Sigmoid Transplant*[1]

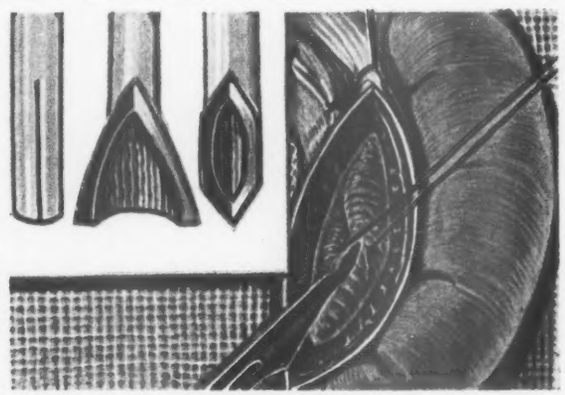


1. Sigmoid colon exposed through a paramedian incision (inset). Sites of future incisions to expose ureter and for transplant to colon are shown as black lines on parietal peritoneum and anterior tenia of sigmoid.

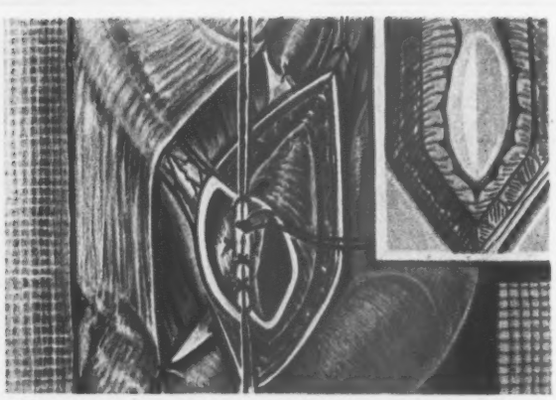
2. Peritoneum is incised and sigmoid loop is brought close to ureter. Edge of peritoneum is sutured to the sigmoid and the ureter is mobilized.



3. Section of ureter is tied off and ureter is divided between ligatures. Incision in anterior tenia of the sigmoid is then started as indicated.



4. Incision is continued through the sero-muscular coat of the sigmoid. Note scalpel about to make opening in the mucosa after deepening lower end of incision. Inset shows steps in trimming ureter.



5. Ureter is being sutured to the mucous membrane lining the sigmoid loop of the colon. (Inset shows the appearance of the end of the ureter after completing this mucosal anastomosis.)

6. Sero-muscular coats are sutured over ureter forming tunnel. Adventitia of ureter is secured to the serosa of the sigmoid. Free edge of peritoneum is sutured to serosa covering sigmoid incision.

Uretero-sigmoid transplant is one of a series of surgical drawings in color illustrating important new operations successfully perfected during the past decade. It is brought to you as a service by Seamless, the world's largest manufacturer of surgeons' gloves. If you would care to examine any of the Seamless Gloves . . . 'Limber-Latex', Brown Milled, or the new 'Crest' for eye, brain, cardiac and vascular surgery, write for a sample giving your glove size.

*Based on an opinion survey of 2,500 general surgeons.

1. Pyrah, L.N., *Ann. Royal College of Surgeons* **14**:169, 1954.

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